FEBRUARY 1952

35¢

WELDING ENGINEER

IN THIS ISSUE: Welding at Solar Aircraft . . . page 17

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500 amps, 11¼" long, 29 oz.

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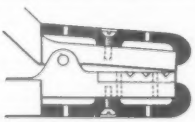

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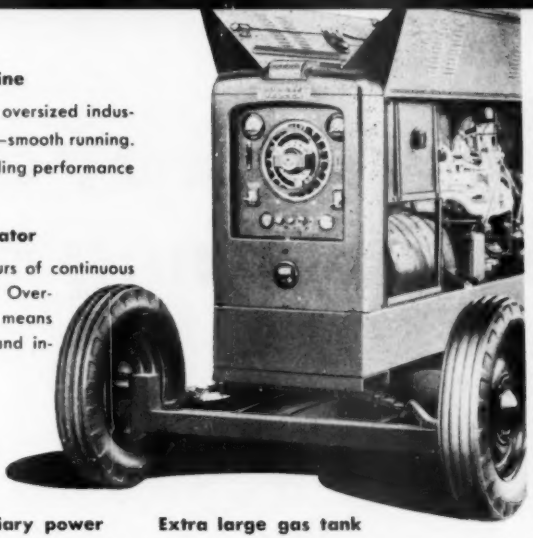

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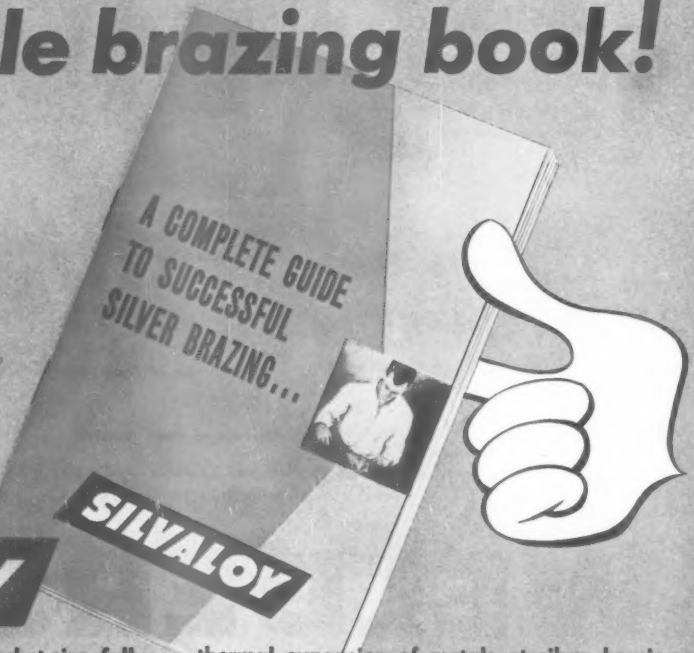

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A McGRAW-HILL PUBLICATION

VOLUME 37 NUMBER 2

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FEBRUARY, 1952

COVER: *This aerial weldor, an employee of M. W. Kellogg Co., is working on an "Orthoflow Fluid" catalytic cracker for the Cities Service refinery at Ponca City, Okla. The camera found him back gouging the root of the inside weld to insure complete penetration of the outside weld.*

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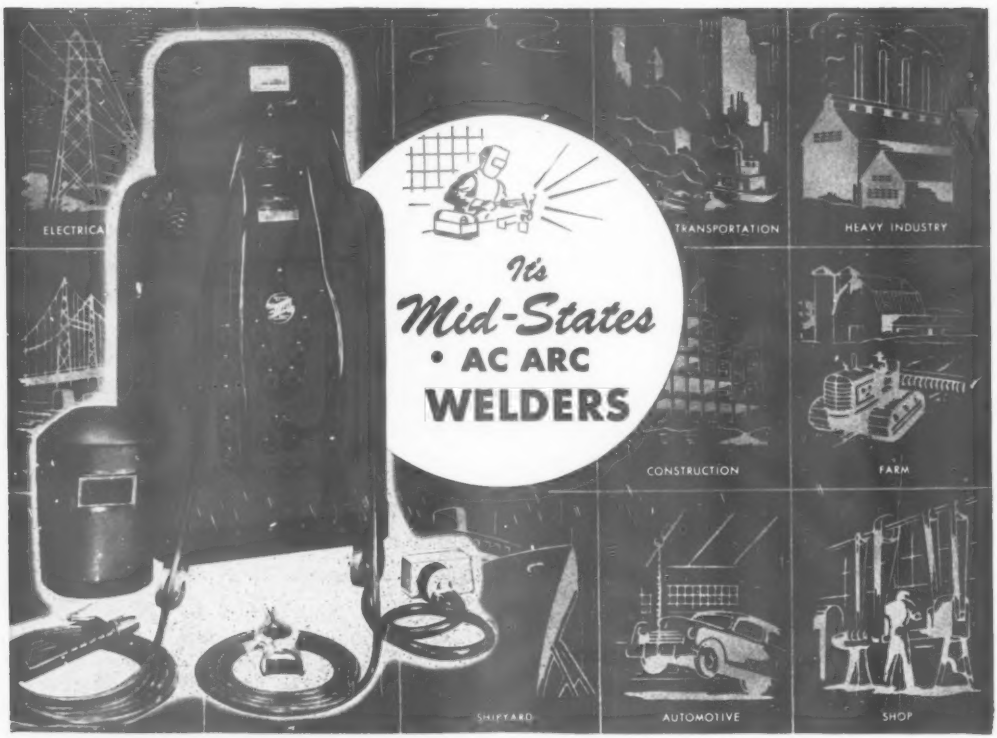

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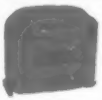

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NEWS FROM WASHINGTON

Dim Prospect Seen for CMP Deliveries

DELIVERIES of controlled materials are coming through much more slowly than anticipated, and defense producers are facing further serious delays, it appears. It is expected that more than 20% of the aluminum promised by the Government for the first quarter will not reach producers until after April 1st, and the brass mill products promised for the first quarter will be short by about 15%, by present estimates. Copper and wire mill and foundry products are in similar inadequate supply.

It seems that DPA, in setting up quotas, deliberately overallotted materials, on the theory that there would be some metal users who would not take all that they were allotted. But DPA's estimates were far too optimistic, it now appears.

Second-quarter allotments of critical materials are expected to be cut below the first-quarter levels, despite the fact that supplies of most of them are expected to increase.

Single Signature May Certify Order

WHAT constitutes a valid signature for certification that an order complies with NPA regulations has now been clarified in an NPA interpretation of Regulation 2.

If the statement of certification is contained within the body of a purchase order or a delivery order, a single signature following the order is all that's needed. However, if the certification follows the purchaser's signature, you'll have to sign again, or write a statement to the effect that the signature serves both purposes. Yessirree, here's a chance for some real saving of manpower!

Sees Overproduction, Not Steel Shortage Ahead

AN INTERESTING prediction, in view of all the moaning about steel shortages, was reported from Frank Purnell, chairman of the Board of Youngstown Sheet & Tube Co. Mr. Purnell believes that steel supplies will catch up with demand as a result of the industry's big expansion program, and that the government just can't consume all the additional steel that will be turned out by industry. Military demands, he said, are taking up only 12% of steel production, whereas during World War II, when steel production was only two-thirds its present level, most of the industry's production was absorbed by military demand.

Meanwhile, the shortage continues.

Oil-Country Tubular Deliveries Restricted

STEPS have been taken by NPA to assure that there will be no distribution of oil-country tubular goods except on authorized controlled materials orders. The restriction on the delivery of casing, tubing and drill pipe is contained in Order M-6A of NPA's Schedule 2, the basic NPA order covering steel distributors.

Schedule 2 also cancels earlier provisions that gave distributors the right to refuse deliveries of steel in excess of specified tonnages during any single week. These tonnage limitations were found too small to meet the minimum requirements for oil-country tubular goods to be used in drilling petroleum and gas wells.

Canadian steel distributors are specifically exempted from this NPA action. Their deliveries are made only under instructions from the Canadian Government's Department of Defense Production.

Structural Fabricators Anticipate Oversupply

AN UNUSUAL complaint reached NPA recently: fabricators of structural steel expressed the fear that the supply would overbalance the demand for their products by the latter half of 1952. As they see it, the demand for structural steel is scheduled to fall off as the program for defense plant building nears completion. And when that happens, they're afraid they will be left holding a bag – full of structural steel – with no place to sell it.

What they ask is for NPA to take the brakes off contracts for public schools, roads, etc. That way, they could "schedule ahead" or, to put it more directly, they would be assured of good healthy backlogs—making it a sort of "social security" for fabricators—by not having to scramble for business in a competitive market.

NPA hasn't given a direct answer to the structural steelmakers' plaint. The word from Washington is that there will be plenty of new demands for steel to replace the requirements of the defense plant building program. Expansion of the electric power program is one case in point since the electric utilities are planning to increase generating capacity by approximately 30 million kilowatts in 1952, 1953 and 1954.

RWMA Advisory Body Gives Recommendations

RESISTANCE Welder Electrode Manufacturers Industry Advisory Committee has presented constructive recommendations to NPA, for its consideration. Of primary importance was the suggestion that MRO orders for electrodes needed for military purposes be given the A, B, C, or E rating assigned to the agency handling the defense contract. At the present time, all rated orders received by the industry are MRO, and the manufacturers have no way of determining from the industry's CMP-4B applications which ones are for military use.

Military orders for electrodes for the jet engine program are just beginning to arrive, and increasingly heavy orders are anticipated; the full impact of this program has not yet hit the industry, which is still manufacturing for civilian needs. It is suggested that the military advise contractors for the aircraft program to order electrodes six months in advance of need, so that

NEWS FROM WASHINGTON

orders can be placed at the mills, and delivery be assured when needed.

The Committee meeting was held under the chairmanship of P. M. (Pete) Hall, of NPA's Metalworking Equipment Division. Committee members present were: H. A. Mullen (Ampco Metal), R. H. Taylor (Electroloy), W. G. Fetter (P. R. Mallory), J. C. Cox (S.M.S.), H. D. Weed (Weiger-Weed), C. R. Schroder (Weldaloy Products), and R. J. Farr (Welding Sales & Engineering).

Welded Wire Mesh Now Under CMP

Welded wire mesh made of either carbon or stainless steel was one of the ten Class B steel products reclassified as a controlled material beginning with the first quarter of 1952. This product, along with specified kinds of woven wire netting, wire rope, staples, spikes and brads, nails, ridge roll, siding, roofing, and die blocks, is now under complete allocation in the same way as basic steel, copper and aluminum materials previously classed as controlled materials.

The move was taken, according to NPA, because of the general tightness in the supply of steel products. It should help insure adequate supplies of these items for military and defense-connected production.

Priority Ratings for Installation Allowed

A recent amendment to CMP Regulation 5 should help weldors with some of their installation problems. The following are the new terms of the amendment:

1. Manufacturers may obtain materials needed for the installation of equipment in an existing building on a priority basis, in the same way that they obtain minor capital additions. However, the limit is two tons for carbon steel, 200 pounds for copper products, and aluminum, stainless steel or alloy steel may be used.

2. Separate minimum quarterly quotas of $1000 each are set for MRO supplies, minor capital additions, and installations. Previously the total minimum was $1000 for both MRO and capital additions.

3. The limit which a manufacturer may spend for each minor capital addition has been raised from $750 to $1000, when he uses the MRO symbol to obtain materials.

4. Expendable tools, jigs, dies and fixtures used on production equipment are now included in the definition of operating supplies, regardless of how these are classified in the firm's accounting.

In addition, the DO-MRO rating can now be used for steel nails, wire and strapping used for packaging; these items have been removed from the prohibited list. It is also pointed out that a manufacturer who makes "A" or "B" products for his own MRO must obtain the symbol MRO to secure controlled materials, and the rating DO-MRO to obtain non-controlled materials to make such products, rather than apply to NPA for an allotment of controlled materials or for a DO rating.

Self-Certification Leeway Curbed

Small users of controlled materials will not be able to write their own priorities as freely as before, as a result of Direction 1 to CMP Regulation 1. In the past, users of certain limited amounts of steel, copper and aluminum were spared the complicated routine of application procedures on their own certification that they were "small users." For the second quarter of this year, however, the small-user self-certification privilege may be exercised only by those whose requirements in that quarter do not exceed their average quarterly consumption of the materials during 1950.

Another action, Amendment 1 to CMP Regulation 1, does away with restrictions on carry-over orders. Until now, a manufacturer who placed an order for one quarter, but didn't get delivery until after the beginning of the next quarter, had to count the delivery against his allotment for the new quarter. Under Amendment 1, which is effective immediately, the manufacturer counts the controlled material for the quarter in which he expects delivery. Thus, he is not penalized for delays not of his making.

Metal Use Not to Exceed Allotment

Beginning April 1st, manufacturers will be permitted to use no more steel, copper or aluminum in any quarter than they are allotted for that quarter, except by express permission of NPA, according to Amendment 2 of CMP Regulation 1.

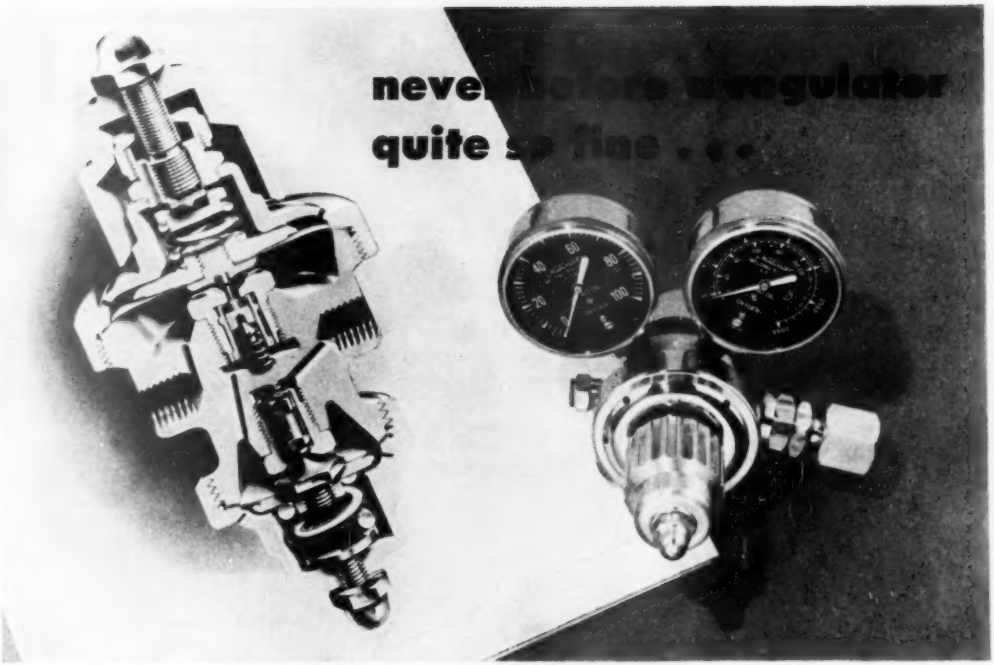
At first glance, this appears to be a statement of the obvious. Actually, while limited allotments have been in effect for a long time, there has been no limitation on the extent to which a manufacturer might dig into his inventories. Thus, this is an inventory conservation measure. There is, however, no intention of telling a manufacturer how much of his product he is to make, NPA emphasizes. If the maker can devise means to stretch his controlled materials over a larger number of production units by means of conservation and substitution, there are no bars to his doing so.

Briefs . . .

Between 5000 and 10,000 manufacturers failed to file new price ceilings under CPR 22 and 30 by deadline time (December 19, 1951), OPS estimates. OPS Enforcement Director Edward P. Morgan said a survey would be made in an effort to get compliance from those who have not filed; if that fails, injunctions will be sought against them.

* * *

Machinery manufacturers who started in business during 1951, or who are making new products, may have until February 20 to figure their new price ceilings under CPR 30, according to OPS. Until that time, they are permitted to use ceilings set by the General Ceiling Price Regulation.



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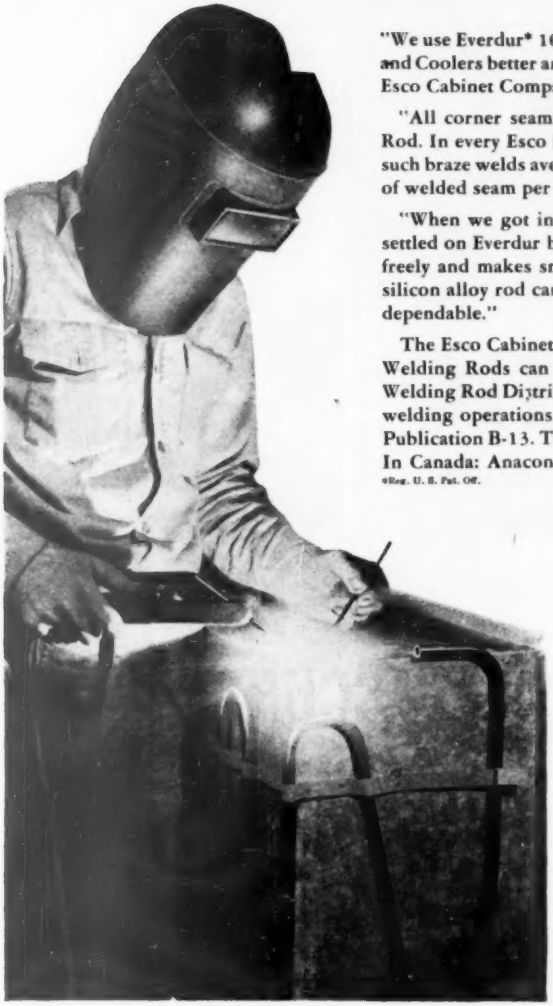

"We use Everdur* 1010 Welding Rod to help build our ESCO Freezers and Coolers better and faster," says Mr. H. R. Smithson, Chief Engineer, Esco Cabinet Company, West Chester, Pa.

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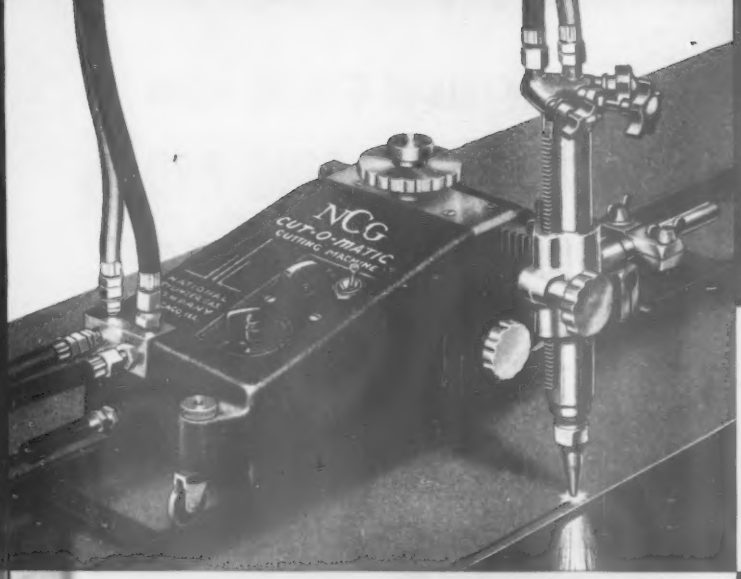

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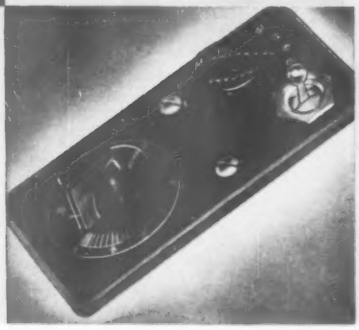

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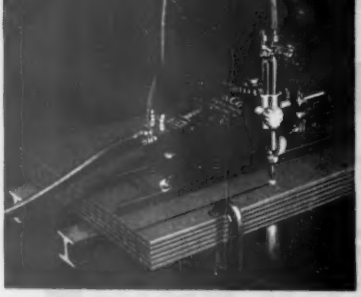
Yes, the NCG Cut-O-Matic is so efficient and so flexible in use that one man and a Cut-O-Matic make a hard-to-beat team to save time, labor, and materials.

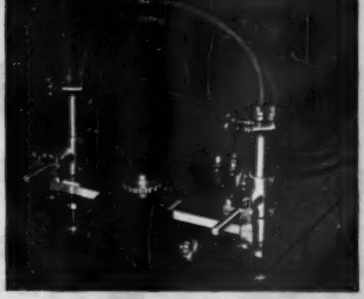
The Cut-O-Matic is not only a money saver in the larger plant but in small shops, too. In countless instances the low price of the Cut-O-Matic has enabled small businesses to enjoy the recognized superiority of machine cutting—with its sharper, cleaner cuts and its overall economies in time, materials and gas.

Cut-O-Matic offers so many advantages that you'll want a copy of the illustrated booklet describing the unit in detail. If you'd like a demonstration right in your own shop, just check the box in the coupon at the right.



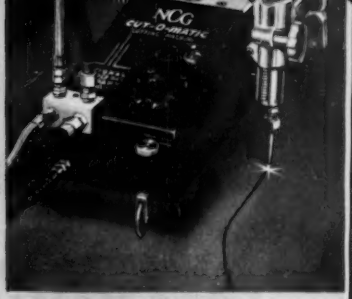
STACK CUTTING

Stack cutting gives real production economy and speed. Sheets clamped together may be cut uniformly. Circles and arcs as well as straight lines are easily stack-cut.



STRIP CUTTING

Strips up to 29-in. wide can be cut by adding torch holder, torch and hose assembly. Wider strips may be cut by using extra length equipment. Narrow strips may be cut by mounting two torches side by side.

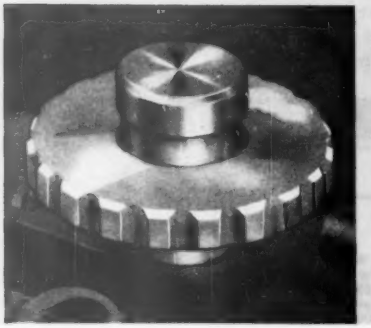


IRREGULAR SHAPES

Limited irregular shapes may be cut by guiding the Cut-O-Matic by hand. Rear wheel is castered to facilitate travel. Cuts are much better than those made with a hand cutting torch.

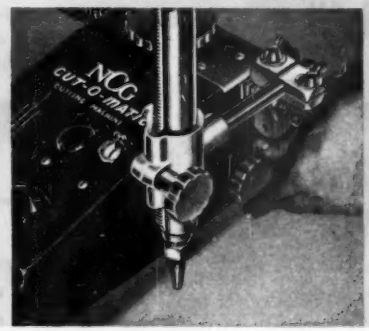
FREE-WHEELING

Fingertip clutch control is combined with a cross-feed gear rack adjustment to permit moving the machine on track while adjusting the cross-feed, in one simultaneous operation.



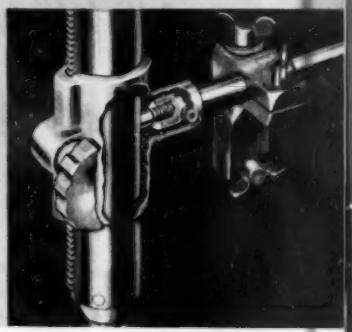
EASY CHANGE-OVER

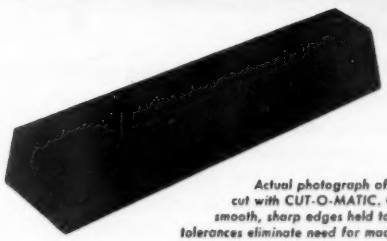
It's easy to switch from cutting straight-line to circles. The friction knob is loosened, as illustrated, and the inside drive wheel is disengaged. The outside wheel then propels the machine around the center point.



SMOOTH—RIGID

No ragged cuts caused by excessive play and uneven rocking. A special clamp adjustment, plus a spring-loaded pressure plug, holds torch in rigidly, yet permits smooth rocking.





Actual photograph of bevel cut with CUT-O-MATIC. Clean, smooth, sharp edges held to close tolerances eliminate need for machining or grinding.

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$210

Complete with torch, tip, radius rod, track, hose, cable and torch wrench.

CUT-O-MATIC possesses all the quality characteristics of famous NCG heavy-duty flame-cutting equipment. Sturdy, simply designed for efficient operation and easy maintenance, the CUT-O-MATIC is a dependable tool that will give you long trouble-free service.

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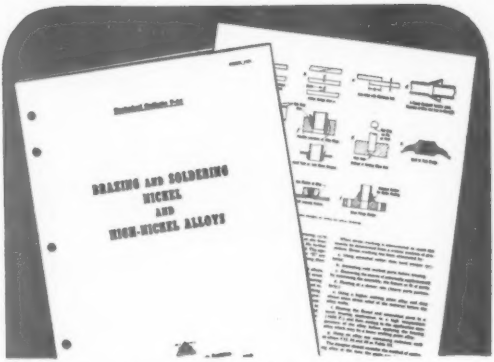
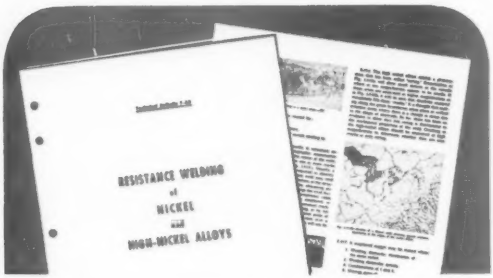


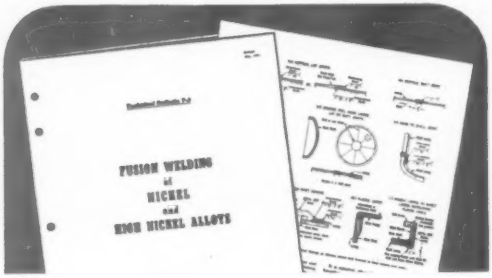
T-34, "Brazing and Soldering Nickel and High-Nickel Alloys"

This is the newest welding publication from Inco's Technical Service Section. It covers design, surface preparation, fluxes, heating methods, post brazing treatment and inspection for silver and copper brazing. It also contains valuable tables on properties and formulae and a section on soft soldering.



T-33, "Resistance Welding of Nickel and High-Nickel Alloys"

T-33 covers design and equipment considerations, welding procedures (both for similar and dissimilar metals), checks for defects and tests for spot, seam, projection and flash welding. It also covers resistance brazing. It gives tables on chemical analysis and mechanical and physical properties, and recommended conditions for welding. The text is amply illustrated with valuable diagrams and photographs.



T-2, "Fusion Welding of Nickel and High-Nickel Alloys"

T-2 covers surface preparation, joint designs, jigs and clamps, electrodes, current, pre-heating, flux and welding procedures for metal arc and gas arc welding. It discusses overlays on cast iron and joining of dissimilar metals; and the preparation, application and testing of linings. It contains tables of chemical analysis and mechanical and physical properties and electrode requirements. Like T-34 and T-33, it is heavily illustrated with diagrams and photographs.

Inco's Technical Service Section wants you to have all three of these bulletins to complete your library on the most up-to-date welding techniques. There is no charge for them. Write today for T-34 and if you don't have T-33 and T-2 ask for them, too.

Remember, Inco Welding Materials take longer to get because so much is being diverted to defense. But, Inco's Technical Service Section is always ready to help on your special welding problems.

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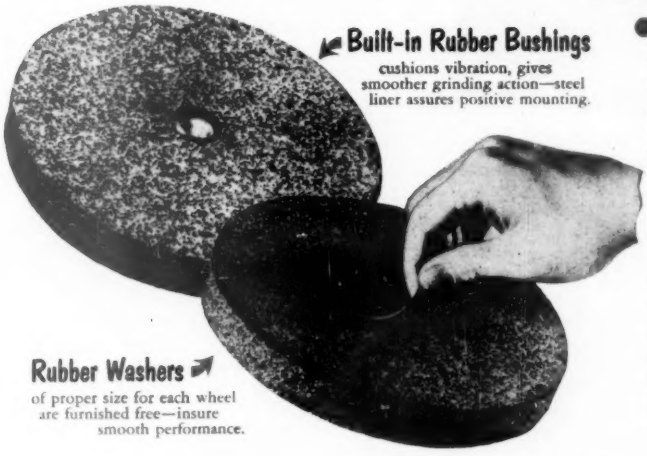
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81-66

NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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MACHINE BUILDER SIMPLIFIES SERVICE PROBLEMS WITH WELDED STEEL

By **Walter E. Vuchnich**
Welding Engineer
Milwaukee, Wisconsin

IN the original design of the side frame member (Fig. 3), service replacement of babbitt bearings for cross shafts required extensive disassembly of the machine. With the welded design (Fig. 4), however, it is now possible to utilize self-aligning roller bearings held in retainers that are simply bolted to the side frame member. All servicing can be done on the job with minimum down time.

The present welded design also affords other important benefits in manufacture. 49% less metal is needed. What little machining is necessary is done on light, fast machine tools. Shop assembly is simpler and can be done with fewer man-hours.

The shop cost of the welded steel frame is 21% less than that of the original construction.

Fig. 3—Original construction *of side frame member weighed 47 pounds and required larger machine tools for boring the retainers for babbitt bearings.*

Fig. 4—Present welded steel design. *Side members are formed from sheet steel. Individual retainers for self-aligning bearings are held to sides with three bolts. Photos courtesy The Fox River Tractor Company, Appleton, Wisconsin.*

PROPER DESIGN IN WELDED STEEL ALWAYS IMPROVES PRODUCT AND LOWERS COST

Fig. 1—Original design *of machine feeder roll required 63 pounds of iron.*

STRONGER, MORE RUGGED

Fig. 2—Weldesign in steel takes 55% less material. *Costs 45% less to build. Eliminates former breakage in service.*

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Machine Design Sheets are available to designers and engineers. Simply write on your letterhead to Dept. 72.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND 17, OHIO

ESTABLISHED 1916

THE WELDING ENGINEER

FEBRUARY, 1952

Are Electrodes Priced Too Low?

THE COMING "sixth round" of wage boosts probably means prices are going up again. When, if ever, the vicious spiral will be brought to a halt is anybody's guess. Like most Americans these days, I wince every time I have to pause at the checking counter at the grocery store. I feel, as you probably do, that I am paying far too much for food, clothing and practically everything else.

Nevertheless, there are cases where higher prices are justified. This is particularly true of products that have been priced too low over the years. And the star performer in this classification is without doubt the humble arc-welding electrode.

Steel has gone up, so have other metals, yet the arc-welding electrode actually sells for less than it did in 1935. If there is any other product that does, I can't think what it is. Technological advances in manufacture account for some of this amazing phenomenon of present electrode prices, but fear, just plain fear, probably accounts for most of it.

It seems to me that most of the fear is senseless and unjustified. Why should a manufacturer of welding electrodes be afraid to price his product to allow himself a fair profit? Are people going to stop welding if the price of electrodes goes up a few cents a pound? Frankly, I doubt it.

At 6c, 8c, 10c or even 15c a pound, a welding electrode is still the cheapest ingredient going into a weld. Deposited weld metal in a joint is estimated to cost anywhere from $2.25 to $3.50 per pound, including material, labor and machine expenses. The cost of the electrodes is only a small percentage—1.7 to 6.7%—of the total cost of deposited metal.

LET'S SEE what happens if we double the price of electrodes. How much does this increase the overall cost of deposited weld metal? Believe it or not, the increase would be under 7%. The user of welding would not be affected very much, nor would the ultimate consumer of welded products. On the other hand, the electrode manufacturer would be helped considerably.

I don't mean to advocate that electrode prices should be doubled. Maybe that's too much of an increase. But getting the right price on welding electrodes, whatever the price may be, will help all the welding industry as well as the manufacturer. Let's look at that a bit.

IN THE FIRST place, welding electrodes would become a profitable item to sell. Distributors, who now claim they handle them on a break-even service basis, would find themselves making money out of their electrode sales. They'd work hard to sell more electrodes instead of just filling the orders that come in. This, of course, would excite competition and put everybody on his toes.

Second benefit is that electrode manufacturers would have more money for research. Without doubt, they would find new ways to improve their products. Nobody has much of a quarrel with the quality of present electrodes, but there is always room for improvement in anything.

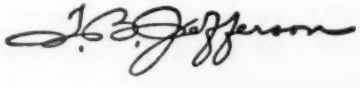
Some of the research might well be directed toward the finding of new applications for welding. Welding, like everything else, doesn't stand still: it either forges ahead or slips back. A lot of progress has come because users of welding have experimented and found new ways to use the welding processes more profitably. Much more progress would come from directed programs of research.

Without funds a company can't engage in research, and without research how can welding applications grow?

I don't mean to criticize electrode manufacturers' present programs of research. A great deal of good work has been done, but not enough.

When new materials like titanium are in prospect, electrode makers must be ahead of the demand. Titanium, for instance, is supposed to be unweldable by ordinary fusion methods, but maybe this is just because we don't know enough yet. We could learn more if funds were available for research programs.

The pioneers of today are the men working in research laboratories. If there were more of them, everybody would benefit.



Solar Aircraft Welds Close to the Edge

Material does not split out, spattering is reduced on this jet engine part because G-E slope control permits a gradual increase in welding current that also reduces tip pick-up and spatter. More welds can be made before electrodes must be cleaned. Welds are sound and uniform. Bulletin GEC-534.

G-E Slope Control for Resistance Welding Prevents Split-outs on Stainless Steel Jet Engine Parts

More precise work possible with this resistance welding accessory used with G-E synchronous control.

Solar Aircraft, like many other plants working on jet engines, has found G-E synchronous control, with slope control added, will enable operators to work to closer tolerances, produce faster, with fewer rejects. The part shown is welded close to the edge but does not split out, and spatter is reduced on both stainless and mild steel.

Use G-E Synchronous Control wherever AN-W-30 and 32 specifications must be met. It assures consistently uniform high quality welds—operates quietly, requires little maintenance. Like all G-E electronic equipment, it has long life, is enclosed in a compact unit that may be mounted on the welding machine or wherever convenient. Easily inspected. Write today for Bulletin GEA-4699. *General Electric Company, Schenectady, N. Y.*

Be sure of consistent, high-quality welds with these G-E Accessories

DETERMINE THE BEST TIMING FOR A JOB **Portable, inkless G-E cycle recorder makes a record of the exact timing on test welds, is then used as a check to verify the setting on machines in production. Bulletin GEC-376.**

HOLD WELDING CURRENT CONSTANT **Regardless of line-voltage variations of as much as plus 10 per cent and minus 20 per cent, the G-E electronic voltage-regulating compensator holds welding current constant. Bulletin GEA-4223.**

REDUCE BRITTLENESS **Heat treat medium-carbon, low-alloy, or high-alloy steel with G-E tempering control. Easily installed and operated. Adjustable to suit thickness and type of metal welded. Bulletin GEA-4201.**

MEASURE ELECTRODE FORCE **Check existing gages on spot, seam, or projection welders or at time of set up. Easy to use, saves time, acts as a production check. Force range: 0 to 4500 pounds. Small, portable. Bulletin GEA-3628B.**

PREVENT CURRENT VARIATIONS **Where the insertion of magnetic material in the throat of the welding machine causes weld variations, the current-regulating compensator keeps current constant to within plus or minus two percent. Bulletin GEA-4207.**

GENERAL ELECTRIC

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All TUBE-TURN Welding Fittings and Flanges are design *engineered* and held to extremely close manufacturing tolerances giving the utmost in strength, safety and efficiency. You'll find a TUBE TURNS' Distributor in every principal city. Call him for good service in good connections.

Be sure you see the double "tt"

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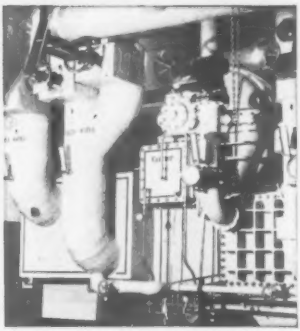
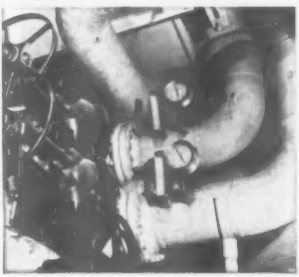
Welded piping reduces maintenance for City within a City



Piping for refrigeration machines, ranging up to 14 inches, is trouble-free. Use of TUBE-TURN Welding Fittings also speeded up erection of piping, since most assemblies were shop-welded, then tied into the systems they serve. Insulation was applied easily and is permanent.



District heating plant supplies steam at 150 psi. Steam is then sent through headers fabricated with TUBE-TURN Welding Fittings ranging up to 12 inches, and distributed via steam stations. Optimum flow conditions have been obtained and maintenance overhead minimized.

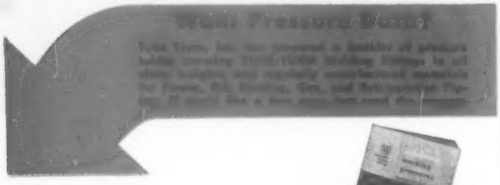
● Service requirements for the Rockefeller Center group of 15 skyscrapers add up to big figures.

The Center consumes nearly half a billion pounds of steam each year.

The famous outdoor skating rink is kept in use even when temperatures are in the high sixties.

A total of 8,000 tons of refrigeration is available for air conditioning.

But maintenance on all the miles of piping is kept to a minimum. All critical piping systems are welded, and directional changes made with TUBE-TURN Welding Fittings. Thus piping is permanent and leakproof, and vital services are maintained without interruption.



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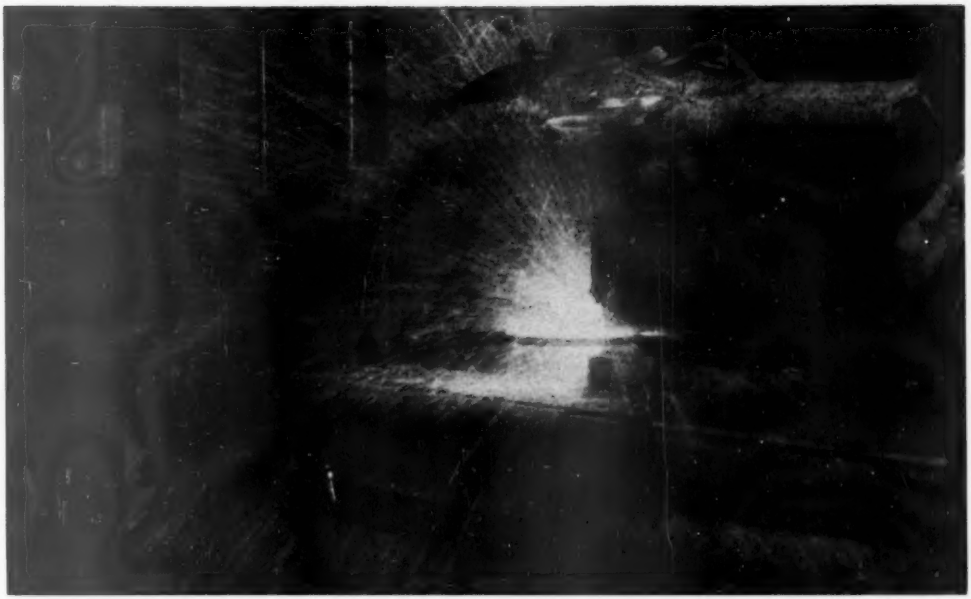


1—FLASH-BUTT welding joins rings varying from 6 to 39 in. OD after they have been made by bending bar stock

Welding Jets at Solar Aircraft

High-temperature components for J33 and J35 jet engines aren't easy to weld. A good deal of ingenuity was needed to develop set-ups at Solar Des Moines.

BY CLYDE B. CLASON

SOLAR Aircraft Co. got into the jet-engine business through the back-door—by making exhaust sections for planes powered by internal-combustion engines. Since a jet engine is practically all exhaust, the transition becomes obvious.

Solar Des Moines, a vigorous offshoot of the parent company at San Diego, Calif., is now putting forth an offshoot of its own. This is the new Wakonda plant, a sprawling single-story structure located just under a mile from the present Grand Avenue plant in Des Moines. The Wakonda plant, expected to be in full operation by February, 1952, will provide 300,000 sq ft of floor space to manufacture components for Allison T40 and J71-A-J10 and for Packard J47-E-23 jet engines. The programs for J33 and J35 jets will continue at Grand Avenue.

Major operations in the new plant will include forming, welding, machining, heat treating and assembling. It will contain about 45 mechanical and hydraulic presses, of capacities ranging from 60 to 1,000 tons. Giant heat-treating furnaces, capable of treating stainless steel at temperatures up to 2,150 F, will be installed. Machine tools will include both horizontal and vertical turret lathes, tool room and engine lathes, milling machines, grinders, shapers and drills.

CONVEYOR-LINE ASSEMBLY

The Wakonda plant will continue the trend toward mass production of jet-engine components. Many conveyor lines will be used, along with automatic machines, a number of which were specially designed by Solar engineers. All machines including welders are being painted in the company's color-code—light green for framework, bright orange for moving parts, yellow for electrical system parts.

The Wakonda plant alone will employ about 90 resistance welders and approximately 65 fusion welders, mostly inert-arc. In both Iowa plants, some 250 resistance welders will be in service, forming what the company claims is the largest bank of these machines anywhere in the nation.

It is as yet too early to talk about welding operations in the new plant, but they will not differ greatly from those at the big five-story Grand Avenue plant. In the manufacture of the high-temperature components of J33 and J35 jet engines, Solar uses practically every major welding process at some stage or another.

One of the company's biggest assets is its welding research laboratory, where constant experimental work is being carried on under the direction of P. Gordon Parks, chief welding engineer. While the design of a new part is being worked out,

2—SUBMERGED-ARC welding eliminated machining of J-grooves to prepare edges for adding flange rings to ends of J35 turbine case

3—INDUCTION brazing is done to add connections to drain off unburned fuel

the welding research laboratory secures information on the proper method of welding it. Sometimes the design is changed so that welding may be done more economically.

In the laboratory are resistance welders of all types, an inert-arc welding head and the necessary equipment for metallurgical inspection, tensile and shear testing, etc. All available welding processes are tried out experimentally until the right process is found to make each weld. This is only the first step. If the part is to be resistance welded, the machine settings are worked out in detail before the part goes into production. If a fusion welding process is employed, the tests are carried on to determine the best electrodes or filler rods to use and the optimum welding procedure.

Jig and fixture design for each welding task is also worked out in the welding research laboratory, in close coöperation with the tool engineering department. "To get the fixture right for the particular task is half the battle," says Gordon Parks. "The other half is the proper evaluation of the welding process."

Let's look at an example of how important a fixture can be. One production part is formed of heat-resisting alloy N-155 to enable it to withstand temperatures up to 1,850 F. The welded parts were developing stress cracks in the areas adjacent to the weld zone. Personnel of the research laboratory sat up late at nights trying to find the answer. They finally discovered that it was loading in tension during welding that was causing the stress cracks. A fixture was designed to clamp the parts so that they would not be under tensile load during welding, and the trouble disappeared.

Inspection Methods

Inspection and quality control are naturally most important to the manufacture of jet engines. "If it's a bad weld, it doesn't leave the plant," is the slogan of the company's welding engineer. To assure that it does not, a variety of inspection processes are employed.

Castings, forgings and other simple parts are tested prior to welding by means of a fluorescent-penetrant process. The parts are first coated with a penetrating oil, then wiped and coated with a fluorescent powder. In a dark room, under ultra-violet rays, tiny cracks show up as luminous lines. It is much less costly to reject the defective parts at this stage than after they have been welded into larger assemblies.

The great bulk of fusion-weld inspection is visual. However, X-ray inspection of selected samples is done for quality control.

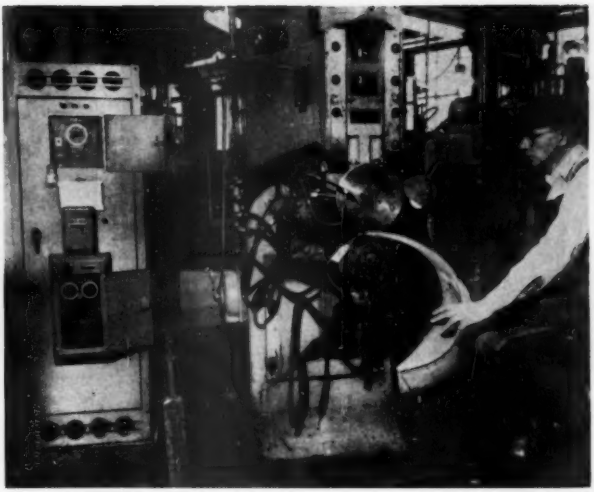
Quality control is of prime concern with regard to resistance welding. Samples of welded parts are taken from each welder at hourly intervals for shear-strength tests and inspection of the degree of fusion and the size of the weld nugget. The values determined, together with hourly heat and pressure readings, are plotted on a resistance-welding quality control chart, one of which is kept for each machine. Any values above or below the specified tolerances will stand out like a sore thumb on the chart.

Materials, Welding Methods

Most Solar jet-engine parts are fabricated from type 347 (columbium-stabilized) and type 321 (titanium-stabilized) stainless steel. Inconel and Inconel X are employed where greater corrosion resistance is needed. For high-strength service at temperatures ranging around 2,000 F, costly cobalt-base "superalloys" such as L-605 and N-155 are needed. Aluminized steel is used for parts operating at low temperatures, "low temperatures" being considered anything below 900 F.

To weld these various materials, many different processes are employed. The broad line of demarcation is between the fusion and the resistance welding processes. The trend is very naturally toward the resistance processes, which are best

4—PROJECTION welding adds louvres to reinforce an inner combustion liner



5—SEAM WELDER above is controlled by forward and reverse slope control to weld a flange on the housing of a fuel manifold assembly

adapted to automatic and production-line operations. The fusion processes, however, and particularly inert-arc welding, are at present indispensable and can probably never be replaced for many applications.

Number of workers may serve as an indication of the current relative importance of the two main branches. Of some 2,100 employees at the Grand Avenue plant, 105 are fusion weldors and 145 are operators of resistance-welding machines. New fusion weldors are being trained constantly in a department that operates from 8 in the morning to 8 at night and has booths enough to handle up to 20 men at a time.

Of the resistance-welding processes, the most widely used are, of course, spot and seam welding. Spot welds tack assemblies together and also serve as finish welds for joints that are not required to be gas-tight. Seam welding is used most extensively on practically every major component for J33 and J35 jets. No one at the Grand Avenue plant has ever found time to estimate the number of inches of seam welding that are being done every month. It is probable, however, that the number of seam welds exceeds the number of spot welds, even though there are three times as many spot welders in service as there are seam welders.

Some interesting applications of projection welding will be described later on. In general, it is used in operations where a number of small parts are to be welded onto a comparatively large part.

Flash-butt welding (Fig. 1) joins rings varying from 6 to 39 in. OD after they are made by bending bar stock. Flash welding is also used to add flanges to some circular components.

Fusion-Welding Processes

Of the fusion processes, inert-arc welding is considered the most important. Butt welding of stainless-steel sheets up to 0.078 in. thick is accomplished without added filler metal. All inert-arc electrodes are of thoriated tungsten: they cost twice as much as ordinary tungsten, but they last six times as long—vastly important when tungsten is in short supply. Both manual and machine inert-arc welding are employed, the latter to a much greater extent.

Inert-arc welding with consumable electrodes is being tested in the welding research laboratory, but it is felt that applications for it will be limited. The rate of heat input is simply too great for the comparatively thin-gage sheet stock from which most jet-engine parts are fabricated.

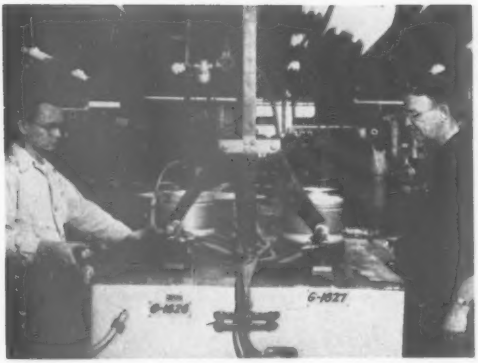
Manual metal-arc welding is confined to applications where speed is preferred to precision—to short runs, curved surfaces, etc., and to fillets and butt joints where filler metal must be added. In comparison with inert-arc welding, its use is minor.

Submerged-arc welding has an important application in welding flanges to each end of the 37-in. turbine case assembly for the J35 engine (Fig 2). It also makes the longitudinal weld in the cylindrical case. Besides this large weldment, submerged-arc welding was found to be the best method of making a very small circular weld on the burner support assembly.

Applications of oxyacetylene welding are limited. Primary use is to add flame-carrying crossover tubes to ring-and-tube combustion chamber assemblies. Silver brazing is done on the inside of the aft frame cone, and induction brazing (Fig. 3) to add drain connections to J35 jets.

The above summary, admittedly rather sketchy, serves to point up a key fact: no one welding process, no matter how good it may be, is able to do all the welding jobs that must be done in the Solar plant.

The basic principle of the jet engine is readily grasped by any normally intelligent person. Its construction, however, is anything but simple. Each engine has hundreds of components, to be joined together by welds running up into the thousands. To describe the production of either the J33 or the J35 engine in detail



6–TWO SPOT WELDS are made at a time on each of these outer exhaust tube bellows assemblies for a J35

7—INERT-ARC "contour" welding. Voltage variations cause head to follow the up-and-down contour of seam

would require a thick volume and is utterly beyond the scope of the present article. The best we can do is to glance briefly at a few interesting examples of different processes.

One production item looks roughly like a wagon wheel. Its three concentric tubular circles are each crossed by two fuel-carrying tubes intersecting at right angles at the hub. Other tubular sections provide "spokes" between the outer and middle circles. The inner circle is formed from a single tube, but the two outer circles are each made by welding together four quadrants. To join this complex array of tubing and avoid distortion was no small problem. Oxyacetylene welding is used because the heat input can be more accurately controlled than with other processes.

The only other application of oxyacetylene welding is to join crossover tubes to the outer exhaust chambers of the J33. The crossover tube is a bellows-type assembly, providing a flexible joint, that carries the flame from one combustion chamber to the next. Because of the crossovers, two spark plugs are enough to ignite all 14 firing tubes. The reason why oxyacetylene welding was selected for this application is that the flame anneals the work-stressed area and minimizes the possibility of stress cracking.

One Part, Three Processes

One "gutter" assembly involves many different welding processes. Since this part must withstand extremely high temperatures, it is fabricated of N-155, a nickel-chrome-cobalt alloy. The assembly is first spot welded to tack it together, then inert-arc edge welded to fuse the flanged edges together. Connector gutters are added by manual inert-arc welding, and the inside corners are metal-arc welded.

Seam Welder Slope Control

Every new development such as slope control is promptly investigated by the company's alert welding engineering department. The Solar Des Moines plant had the first commercial application of slope control to roll welding, and it now has a seam welder controlled by a forward and reverse slope (Fig. 5). This machine is used to weld a flange to the housing for a fuel manifold and gutter assembly. The forward slope goes up to peak heat at a controlled rate of rise, and the reverse slope provides a controlled current decline to allow the weld to cool gradually. Peak heat is, of course, also held for a controlled number of cycles.

Let us look now at an application of projection welding. The part is the inner combustion transition assembly for the J33, to the curved outer surface of which 52 small spacers must be welded. Originally, saucer-type spacers were spot welded into place by means of a tungsten-faced electrode. Since the maximum contact area was only about 1/10 by 1/10 in., it was impossible to get the 100% weld that was required. Spacers would fall off, enter the air stream and be forced against the turbine blades with disastrous results.

Bar-type spacers, ⅛ in. wide by 0.063 in. thick, ended this difficulty. Each spacer is formed with a small projection at either end. The 52 spacers are projection welded, one at a time, to the exterior of the transition section at locations circled by a crayon. There has not been a failure of any spacer weld in three years.

Another job for projection welding (Fig. 4) is to add louvre reinforcements to the inner combustion liner of the J33. There are 35 of these "scoops" to be joined to the cylindrical liner. All but the outermost seven are welded on with the aid of an automatic indexing fixture that saves Solar 80 man-hours per day.

Mounting lugs for the inner combustion liner of the J35 are added by hot upsetting on a spot welder. The lug is held in the hollow lower electrode while it is heated and upset by the tungsten-faced upper electrode. The job is somewhat similar to hot riveting—but it is done by resistance welding.

The plant's single use of induction brazing (Fig. 3) is to add drain connections to the J35, purpose of which is to drain off the unburned fuel and recirculate it for further combustion. After assembly with preformed rings of silver alloy, each part is brazed in an induction coil in a matter of seconds.

Two spot welds are made at a time on the outer exhaust tube bellows assembly of the J35. The automatic fixture does a dual job: it expands the assembly and indexes it after every pair of spot welds has been made (Fig. 6).

One of the most unusual things the writer saw at the Solar plant was an unique "walking" electrode. To join the crossover tube to the outer exhaust chamber of the J35, this electrode makes an overlapping spot weld all the way around the circular mounting plate for the crossover tube. The electrode, the upper one of a pair of spot-welding electrodes, is an offset job specially designed to rotate around the specified circle while a hook moves the crossover tube.

Contour Arc Welding

"Contour" arc welding (Fig. 7) is another unusual process, for which an inert-arc welding head is used. The outer transition section of the J33 is made by joining two half stampings. As a part of the stamping, tabs are blanked out for arc starting and stopping. Variations in the arc voltage are caused to raise or lower the welding head so that it follows the up-and-down contour of the seam. After one side has been welded, the fixture in which the assembly is clamped is turned 180 deg to weld the second seam. When all the welding is done, the part is sheared in two, to make two complete transitions.

And now for submerged-arc welding—as it is used to join flange rings to each end of the turbine case for the J35. Figure 2 shows the operation. The turbine case is a 37-in. cylinder formed from a ⅛-in. sheet of either 347 or 321 stainless; the flange ring is formed from ½ by ¾ in. bar stock of the same material. The old method was to arc weld the ring manually (metal-arc process) from each side. This required the rings to be machined for J-groove welds, a tedious and expensive edge preparation. With submerged-arc welding, it is necessary to weld only one side of the ring since 100% penetration is secured. No edge preparation is necessary, and the labor saving is about two man-hours on each welded unit.

This application of submerged-arc welding was not, however, as easy as it sounds. When the process was first tried out it proved unsatisfactory because stress cracks would appear. The company's welding research laboratory experimented with every stainless filler wire on the market but could not get consistently satisfactory welds. Finally, it worked out its own filler metal of a modified stainless steel. Today all submerged-arc welds are crack free.

To summarize, intelligent use and adapation of every available processs is the key to successful welding in the Solar Grand Avenue plant. It will likewise be the key to welding operations when they start up in the new Wakonda plant.

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The writer would like to acknowledge his debt to P. Gordon Parks, chief welding engineer; William Dixon, assistant chief production engineer; H. J. Siever, legal advisor, and other Solar men who furnished valuable assistance.

Keeping up with the Taxes

No. 2 Inventories

BY HARRY H. ROSE

As a partner in the public accounting firm of Traeger & Rose, Cleveland, Harry Rose is an authority on "down-to-earth" tax law. His articles on tax topics will be a regular feature.

The Bureau of Internal Revenue attaches more weight to consistent inventory treatment from year to year than to any particular method of valuation. However, the inventory treatment should conform to the best accounting practice in the particular trade or business, and it must clearly reflect the income.

The Regulations have given the Bureau wide discretion in the choice of accepting inventory methods. It alone has the right to determine what is the best accounting practice in any particular business, and it is subject to review only when the taxpayer can clearly show an abuse of that discretion. No change in method is permitted without permission of the Bureau.

The choice of valuation methods are:

1. Lower of cost or market. This is the method most widely used;
2. Cost.
3. Market—available only to dealers in securities or commodities dealt in on organized exchanges.
4. Retail store method.

Where the lower of cost or market is used, valuation must be as of the last day of the taxable year. Market value means replacement or reproductive cost. Where cost is used, the general rule is to use the cost of the specific item listed; if not identifiable by specific invoices or job costs, then the first goods in are regarded as the first goods out. Averaging the cost is permitted. An alternative cost method is that the last goods in are the first goods out, and the use of this method requires permission. Under rising prices, the latter method is obviously better taxwise; under falling prices, it is the reverse.

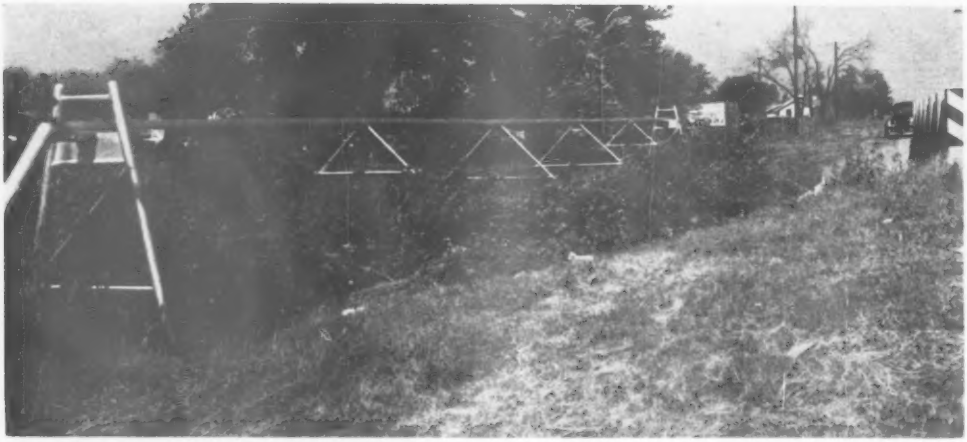
The inventory should include everything that forms part of the merchandise intended for sale. Supplies that do not go into the goods intended for sale are usually treated as a deferred expense.

With reference to setting up an inventory reserve to cover possible price changes or possible losses, the Bureau frowns upon any kind of reserve that attempts to anticipate indefinite or possible future losses as a current deduction. You will not be allowed to deduct an arbitrary percentage to reflect present valuation because it is too indefinite. Even with a percentage deduction backed up by a solid factual basis, it might take a court action to win your point.

Omitting certain items, or skipping the valuation of work in process or taking parts of the inventory at a constant or nominal value is not permitted.

Capital items such as land, buildings, machinery and accounts receivable may not be inventoried.

Inventory valuations are considered as final if they have been correctly taken as of the date of inventory. Sales on approval must be included in inventory prior to acceptance as a sale.

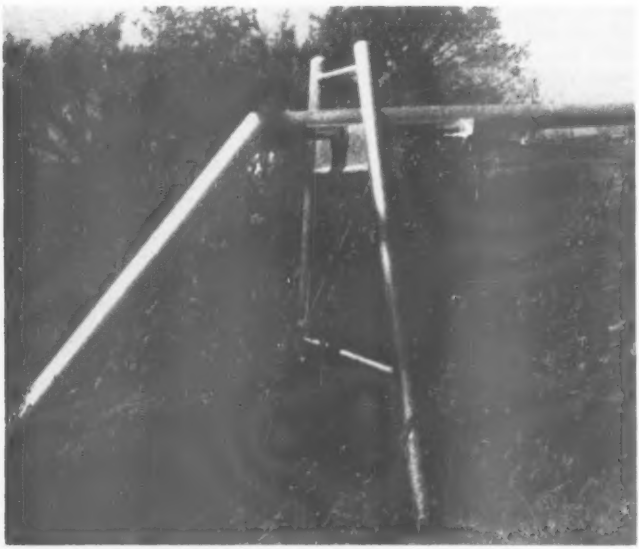


COMPLETED pipe-line bridge. This general view shows how accurately the level is carried across the 125-foot span and illustrates the amount of clearance gained by the construction plan. Floods cannot reach the pipe line

Pipe Line Makes

Study these pictures, and you will see a very novel way of protecting a pipe-line crossing from floods. The pipe itself serves as the 'backbone" or rigid member.

BY ELTON STERRETT



A-FRAME with semicircular bearing yoke in the cross member. The picture was taken when the thermometer stood at 105 F. Expansion had lifted the end free of the yoke without affecting the alignment of the crossing.

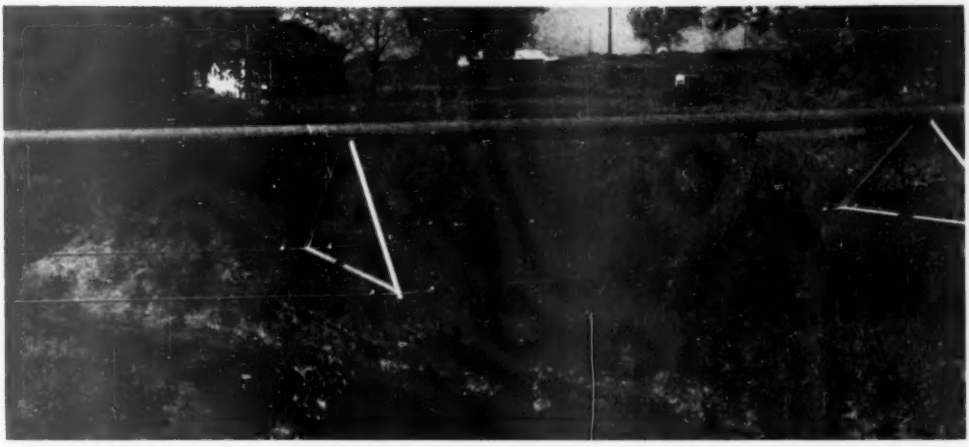
A ROCK BOTTOM in a stream subject to flash floods made the problem of a pipe-line crossing look difficult and expensive. An ingenious application of welding technique, however, keeps the pipe from being swept away by even the most severe floods.

RISERS ELEVATE THE PIPE

The 8-in. line was brought up to the stream banks in the usual trenches. Where the pipe reached a bank, a riser was welded to it at an angle of 75 degrees to the normal line run. Mitre welds at the tops of the risers again brought the pipe run horizontal—but at a height that is out of reach of flood-swollen waters.

Welded A-frames support the 125-ft span some 8 ft above bank ground level. Each of the A-frames was provided with a bearing yoke or sleeve of 8-in. pipe, expanded to serve as cradle for the line pipe.

A reinforcing sleeve or shoe was welded to the line pipe at the point where it bears against the A-frame cradle. The reinforcing sleeve is a 4-ft section of ½-in. wall pipe, opened to fit as a shoe around the lower half of the pipe at each frame and welded at all areas of contact. To the stream end of each reinforcing sleeve, there was welded a semi-



FOUR TRIANGULAR frames were welded to the bottom of the pipe to support cables. Cable clamps helped the cables to act as wind braces, reinforcing the structure against stresses imposed by transversely blowing winds

a Welded Bridge

circle of 1-in. boiler plate, cut and formed to fit the pipe sleeve and to give an outside diameter of 18 inches. Under the pipe, a flat brace and two horizontal pieces of heavy plate formed a spider, onto which was welded a short section of 18-in. pipe. Through this rigid support, there could be passed the adjustable ends of the eyebolts carrying the two ¾-in. cables that were used to strengthen the pipe span.

Triangular Braces Added

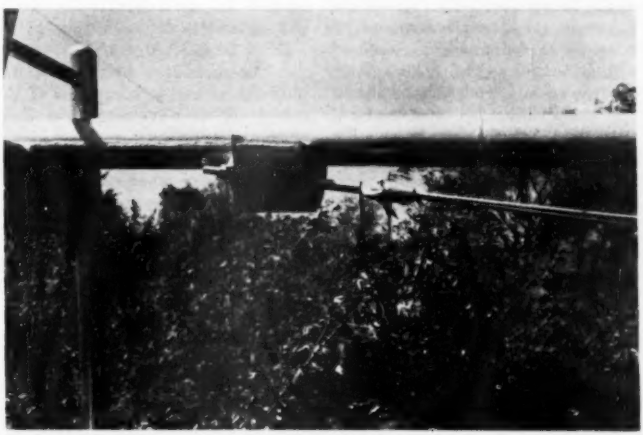
When the pipe had been laid across the stream and temporarily supported on cribbing, four triangular brace frames were welded to it. These triangles were spaced at 25-ft intervals with their apexes at the pipe and their bases hanging downward. In the two base angles of each triangle, there were needed 12-in. lengths of ¾-in. pipe, arranged parallel to the main line. The two cables were threaded through these short pipe sleeves.

After the cables had been threaded, they were cut off and socketed to the desired length so that they would be adjustable as to tension by eyebolts at each end. By adjusting the tension on the cables, the line of pipe spanning the stream could be perfectly aligned so that the pipe was self-supporting when the falsework was removed.

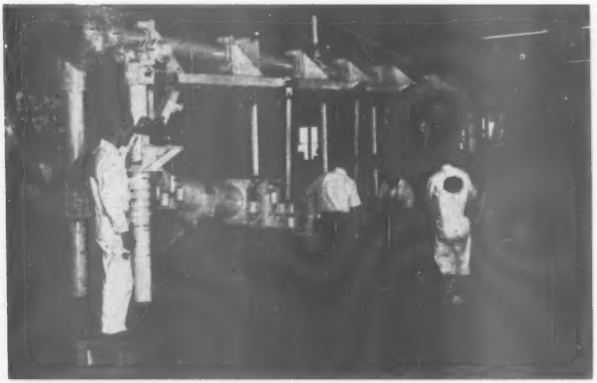
Cables Act as Wind Braces

To enable either cable to act as wind brace against a gale blowing against either side of the line, cable clamps were set on the two wire strands. An inch of clearance was left between the end of the pipe guide and the face of the clamp.

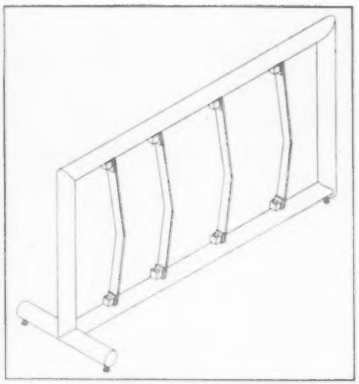
When the cables had been properly adjusted, they served as support for a movable scaffold on which two workmen could stand while they painted the pipe. The entire structure, including the cables, was given a thorough coating of aluminum. This served to reduce the amount of heat absorbed by the pipe and so guarded against expansion shifts as well as providing effective protection against corrosion.



CLOSE-UP of the anchorage for the two ¾-in. cables shows method of welding the anchor to the stiffening half sole of heavy pipe. Reinforcing shoe is welded along the base of the line pipe where it traverses A-frame



THIS BOLT-assembled jig is the type the U. S. Air Force is recommending as a possible solution to the problem of standardization



CAN THIS welded fixture hold its own in competition with the bolted types?

Ways to Save Money

The advantages of welding techniques are well known, but few manufacturers have as yet made as effective use of welded tooling as they might. Here are some ideas.

BY THOMAS A. DICKINSON

INTRICATE molds or dies, which might be cast as a sequence of relatively simple parts for rapid assembly by welding, are being tediously hobbed or machined at costs astonishingly high. Jigs and fixtures that would be comparatively inexpensive, lighter in weight and more accessible if welded are being bulkily assembled with bolts and special fittings. And, in many cases, slightly damaged tools are being discarded and replaced when they could be repaired by welding at a fraction of the cost.

There is ample evidence to show that these practices can be abandoned. Eventually, they will be—for economic reasons, if nothing else. The future is unpredictable, but no matter what occurs it is unlikely that there will be any less need for lower production costs.

Savings on Dies

In the production of die-casting tools, firms such as Harvill Mfg. Co., Corona, Calif., are making extensive use of flame-cutting facilities and pantographs in the preparation of blank stock for parts requiring precision dimensions. True enough, flame-cut parts lack the extremely close tolerances required for interchangeability, but they can be machined in critical areas for a very small portion of the time and money that would be expended if equivalent parts were shaped entirely by machining.

In the fabrication of multiple-cavity dies for molding rubber or plastic products, several organizations (Process Mold Co., Standard Tool Co., and Stainless Cavity Corp.) have demonstrated that first-quality tools for either limited or long production runs can be obtained for unprecedentedly low sums by:

(1) Casting the individual cavities with beryllium copper, aluminum alloys, stainless steels, etc., depending on mechanical specifications.

(2) Assembling the separate cavities for use as a single molding tool and arc welding them together.

(3) Machining special details, such as gates and sprues, on the cavity assemblies.

(4) Electroplating the tooling assemblies, if necessary, to reduce porosity for good release characteristics.

As a rule, no special precautions are necessary to avoid warpage in welding mold assemblies of the above type. If distortion due to the use of heat cannot be avoided, the welded assemblies can be annealed and straightened by a simple hydropress operation in virtually all cases.

Tool and Die Welding

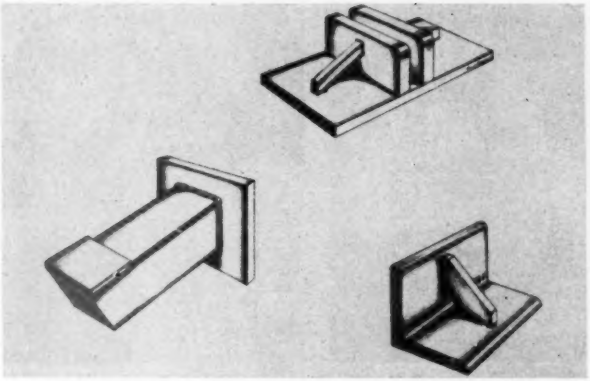
In general, the welding of tools and dies is a job for highly skilled and experienced specialists in this particular line. They must work upon high-carbon steel, either plain carbon or with various alloying elements to add to the welding difficulties. The chief types may be classified as:

Plain-carbon. Carbon content 0.60-1.40%. Water-hardening.

High-carbon, high-chromium. The several steels in this group contain around 12% chromium. Oil-hardening type contains 1-2.15% carbon. Non-deformable steels contain 1.00-2.15% carbon (air-hardening) and 2.15% carbon (oil-hardening).

Chromium die steel. Contains about 4% chromium and 0.90% carbon. Either air-hardening or oil-hardening.

Tungsten die steel. Contains about 15% tungsten and 0.40% carbon. Air-



TOOLING WELDS should be located in areas where no critical dimensions are involved. See the next picture if this isn't possible

SPECIFY welds on tooling assemblies to allow machining to final dimensions

with Welded Tooling

or oil-hardening. Used for dies that do hot work up to 1,100 F. Metal-cutting tools that become hot in service must be made of:

High-speed tool steel, containing around 18% tungsten, 0.70% carbon, plus chromium and vanadium. Air- and oil-hardening.

It is obvious that none of the above materials are easy to weld. Each calls for its own special procedure of preheating and postweld heat treatment. To discuss details would be beyond the scope of this article. A few generalities, however, can be given.

In a two-part article,* "Die Welding by the Metal Arc," Arthur R. Butler, president of Welding Equipment and Supply Co., Detroit, has this interesting point to make about tool steels:

"The hundreds of brands of tool steels you can find on the market boil down to just four classes: water-hardening, oil-hardening, air-hardening and hot-working. Now if you take several different brands from any of these classes—brand "X," say, oil-hardening, regular, and brand "Y," oil-hardening non-shrinkable, and brand "Z," oil-hardening non-deformable—you will find that the recommended heat treatments are the same. Therefore, in tool and die welding, it is not a question of matching the analysis of the steel (it isn't feasible to have an electrode to match each analysis) but of matching the heat treatment."

Tool and die welding electrodes, Mr. Butler says, can be divided into three distinct categories:

Group I: the basic tool-steel welding electrodes: water-hardening, oil-hardening, air-hardening, hot-working and high-speed types.

Group II: Low-alloy electrodes for plastic or zinc casting molds and flame-hardened dies and more highly alloyed electrodes that are used to weld dies for forging, drawing and forming.

Group III: Other alloy electrodes sometimes used in conjunction with tool and die welding electrodes, especially those for application on cast dies for drawing or forming. Nickel-iron electrodes, nickel electrodes and copper-nickel electrodes, says Mr. Butler, can be used as a foundation on cast units before the hard final layer is deposited with an electrode in Group I.

Jigs and Fixtures

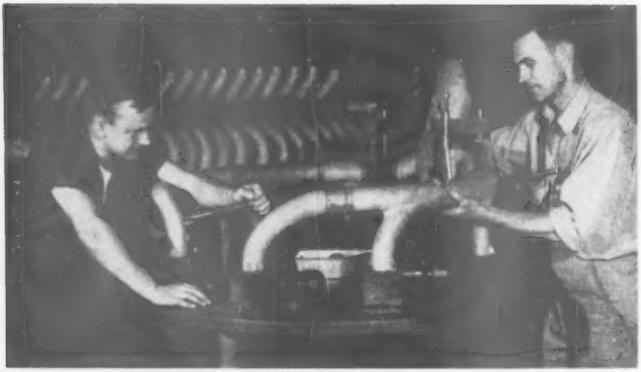
Arc-welded assemblies of oil-well casing and structural steel materials have been extensively used by the aircraft industry for many years to make the basic frames for assembly jigs and fixtures. Such frames can be rapidly fabricated in conformity with virtually all specifications for maximum accessibility and stability. Recently, however, the U. S. Air Force has inaugurated a program for standardizing aircraft assembly jigs and fixtures—a program which could eliminate the use of welded-tool structures.

Idea of the Air Force program is to utilize cast-metal fittings, bolts and standardized structural members so that jigs and fixtures can be assembled like the components of a youngster's Erector set. This idea was initially conceived and successfully utilized by the German aircraft industry during World War II, and it has several obvious advantages when contemplated superficially. It can, for example, facilitate the reclamation of assembly tools that have served their purposes and accelerate the process of salvaging production facilities from bombed-out factories in the event of another war.

Airplane manufacturers, however, are the ones who have to be sold on the idea, and a recent survey among tooling experts in western aircraft factories indicates that they are not enthusiastic about the prospect of abandoning the use of welded jig or fixture structures. Among reasons given for opposition to the change are:

(*a*) The initial cost of standardized

*The Welding Engineer—June and July, 1951.



AIRCRAFT industry makes extensive use of jigs and fixtures. This jig is being readied to weld an exhaust manifold at the Ryan Aeronautical Co.

GAS torch fuses zinc alloy over damaged surfaces of Kirksite die

parts for bolt-assembly tools will be inordinately high.

(*b*) Too many sacrifices will have to be made in terms of structural stability, bulk, appearance and accessibility of assembly tools if standardized bolt-on components are specified.

(*c*) Welded tool structures can be standardized for reclamation purposes without a parallel reduction in the qualities of resultant assembly tools.

As one example, tool engineers at Consolidated Vultee Aircraft Corp., San Diego, Calif., have already made considerable progress in standardizing welded jig or fixture structures by a simple expedient. They adapt basic tooling assemblies to varied producion requirements by replacing the locational elements thereon. This, incidentally, saves the cost of completely disassembling an old tool when a new jig or fixture is required. As for the bombed-out factory line of thinking, it is argued that undamaged parts of welded tool structures can be salvaged with cutting torches as easily as bolted components can be unscrewed with wrenches.

Several companies have found the stud-welding gun particularly useful in assembling such details as dowels on production tools. A dowel is a pin or peg that fits into a hole in an abutting piece. Adding dowels is just the job for stud welding since precision-locating devices may be employed.

Axelson Mfg. Co., Los Angeles, has lowered heat-treating costs by as much as 90% by utilizing oxyacetylene torches for the localized flame-hardening of mold or die components. This method, of course, can only be applied to dies that do not require an overall furnace treatment.

In the Stainless Steel Products plant at Burbank, Calif., the production usefulness of lead and Kirksite dies for drophammer work has been greatly increased through the effective application of welding facilities in repairing the cast-alloy tools whenever slight defects such as cracks occur†. Defects of the type in question do not immediately impair the characteristics of good production tools but could, if allowed to develop, necessitate replacement dies.

When it became necessary to assemble machined steel parts with extremely close dimensional tolerances, Acme Machine Co., Los Angeles, combined gas-welding equipment with refrigeration facilities. Here is the procedure:

(1) Heat expand the female part and shrink the male component by refrigeration.

(2) Mate the parts. They will be strongly united as the result of the combined thermal expansion and contraction.

Points To Keep In Mind

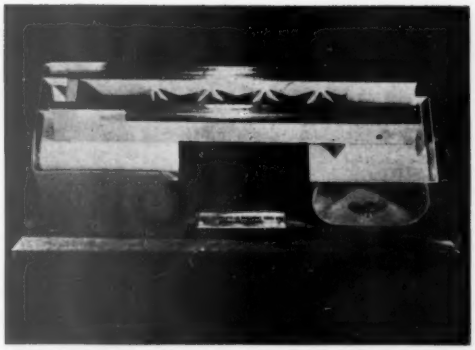
In general, no unusual variations in basic welding techniques are essential in processing production tools. Gas pressures, torch tips, welding rods or electrodes, current settings, etc. can be selected in accordance with the usual considerations that determine the use of such welding equipment for the material to be welded. A few specialized tooling requirements, however, must be taken into consideration by the welding engineer if the best possible results are to be obtained in all circumstances. Here are some of them:

Locate welds in tooling areas where critical dimensions are non-essential whenever possible. If this is not possible, tooling components can be mated in critical areas without disastrous consequences provided that welds are made having the depth and physical properties required to machine to the critical dimensions.

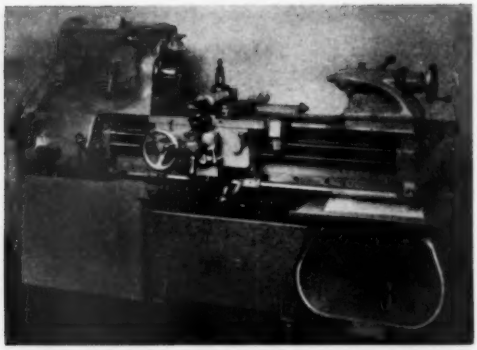
Welds of maximum strength are preferable in connection with the fabrication of most production tools. Relatively weak welds can serve a worthwhile purpose, however, if adaptability is an important tooling requirement. For example, low-melting alloys have been used as fillers in mounting steel locators on assembly jig structures; the positions of the locators can be readily altered if alterations became necessary as the result of toolproofing activities or engineering changes.

While rigidity is a merit that frequently causes tool designers to specify welds in place of bolted or riveted components for production fixtures, it is sometimes desirable to limit the use of welding equipment in order to obtain tools which can be handled or shipped with comparative ease. Large bucks or assembly jigs, for instance, may be fabricated as arc-welded subassemblies that can be bolted or riveted into the final structure. The welded subassemblies may rapidly be disassembled if it becomes necessary to move them.

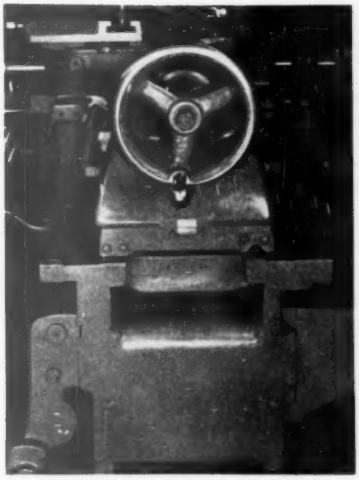
†See pages 35-37, The Welding Engineer, December, 1951.



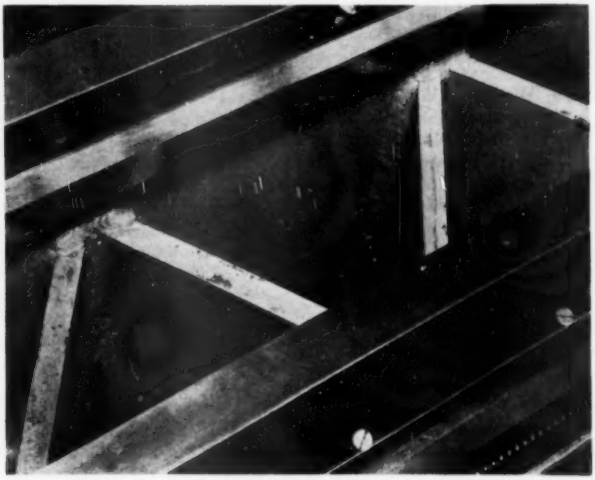
1—SCALE MODEL of steel bed-and-leg assembly of Springfield lathe to resist and absorb shock loading



2—WELDMENTS are used for the bed and legs of the completed lathe. Pan between the legs is removable



3—LOOKING at bed from one end. Note the T-shaped beams that support the ways



4—ANOTHER view of lathe bed, showing some of the diagonal webs that are welded to each other and to webs of way-supporting beams

It's Steel for Shock Resistance

New lathe design replaces the major cast-iron components with weldments in order to withstand shipboard stresses that include deck weaving and the impact of near misses in bombing.

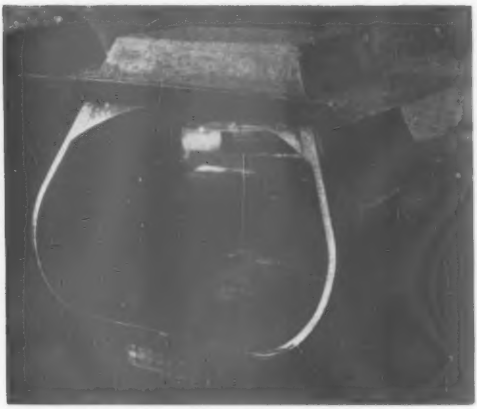
BY EARL OBRINGER AND R. C. MONTANUS*

MACHINE tools employed on shipboard are likely to undergo stresses of an order seldom, if ever, encountered in land-based shops. This is especially true of warcraft and mother ships for naval service in wartime. Bombing, near misses, gunfire, rapid maneuver and even storm buffeting frequently involve stresses far beyond anything normally experienced on land.

Machine tools on naval vessels have been shattered by the impacts and vibrations set up by near misses in bombings. Many cast-iron components have been broken by impacts and deck weaving. In some cases, fragments broken away became serious hazards to personnel.

Naval authorities have sought revision in the design of some machine

*Mr. Obringer is design consultant of The Lincoln Electric Co., Cleveland. Mr. Montanus is vice-president of the Springfield Machine Tool Co., Springfield, O.



5—TAIL LEG: pear-shaped contour was produced by bending a 5/8-in. plate. Other components were welded

6—HEAD LEG as it appears before adding the floor plates. Sides are a "wrap-around" with formed corners

tools. Their thought is that castings, not adequately shock-resistant and subject to fracture in weaving, should be replaced by welded steel. Rolled steel, of course, has a far higher strength and much greater ability to resist shock, vibration and twisting stresses.

Efforts to meet such severe requirements have not gone unheeded. Much progress in a co-operative effort has been made by engineers of the Springfield Machine Tool Co. and design consultants of The Lincoln Electric Co. This article will tell how these two groups worked together to redesign 14-in. and 16-in. Springfield lathes.

Springfield engineers wanted the new lathes to be not only shock-resistant but so constructed that certain shock and torsional stresses would be largely absorbed before they could reach the lathe bed and twist it out of true. Figure 1 shows a scale model of the steel bed-and-legs assembly of a proposed lathe designed for welded fabrication. The assembled structure was highly commended by the naval authorities.

Examination of the new Springfield design, shown as a whole in Fig. 2, reveals that its general appearance is similar to the prior design for cast iron. The important exception is the supporting legs, which are radically altered and entirely new, both in structure and in materials used.

Let us first examine the bed, Figures 3 and 4. It *appears* much like its cast-iron predecessor and has substantially the same dimensions, stiffening webs and section thicknesses, but it is built up by welding steel components. This type of design was adopted for such reasons as:

(*a*) The prototype was highly successful and possessed established merits that could not fail to be imparted to the new design.

(*b*) As sections remained practically unchanged, strength and impact resistance would be increased in the same proportion that these properties for mild steel compare to those for cast iron.

(*c*) According to established formulas, stiffness or rigidity would be four times that for cast iron. This is most important shipboard.

(*d*) Parallel manufacturing methods could be employed. The new bed would fit the headstock, tailstock, carriage and gearbox previously used.

The headstock, tailstock, carriage and gearbox are compact units. They are considered most unlikely to be shattered under any forseeable conditions short of a demolition sufficient to wreck almost any machine of comparable size, whether of cast iron or steel. In consequence, cast iron was continued for these bed-supported components.

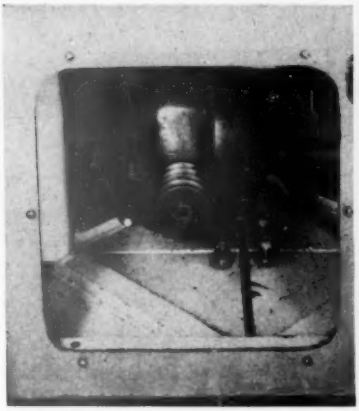
In the case of the carriage apron, a modification was introduced. This apron is normally supported only along its upper edge and, being overhung, could be fractured by transverse impact of great severity. Consequently, a bracket attached to the lower apron is provided. This bracket extends to a way along the lower front edge of the bed; it clears the way by about 0.001 in. If a transverse shock deflects the apron by the small amount allowed for clearance, the bracket bears on and transmits the shock to the steel bed so that the apron does not fracture.

The design for the steel bed is admittedly conservative, but it is regarded as a safe and acceptable first step along pioneering lines. The bed is of great rigidity and strength. It is believed that many sections could be made considerably lighter, saving much steel, and still have ample stiffness and high shock resistance. More experience is needed, however, before the extent of feasible changes can be determined and their results evaluated.

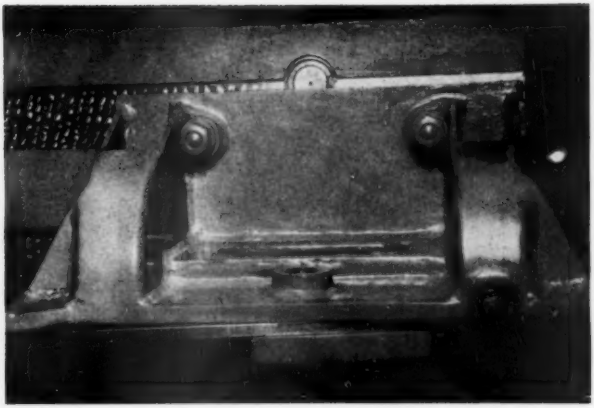
Certain proposed specifications have suggested that lathes for the type of applications here considered should be able to withstand vertical shocks of 20 gravities and horizontal shocks, longitudinal and transverse, of 12 gravities. These are arbitrary figures: there is doubt whether tests to determine the effect of such shocks can be made with existing equipment on full-size lathes. While we believe that the lathe here described could resist such shocks without fracture, our opinion is largely conjectural because we lack the data on which to base definite conclusions.

Bed Resists Torsion

The precision and rigidity of a lathe depends largely upon its bed design. Basically, the bed consists of



7—FOUR leaf springs of the head leg floor may be seen underneath the motor



8—STEEL BRACKET supporting the taper attachment. It is much more immune to fracture by shock than the cast bracket it replaces

two T-shaped beams (Fig. 3) that support ways of hardened tool steel. The two beams are connected by a series of transverse webs in vertical planes; the latter are so disposed that they form nearly equilateral triangles with beam webs (Fig. 4). Both ends of each transverse web are welded with substantial fillets to the next web and to the vertical webs of the beams they connect.

This form of latticed girder is by far the best known of many designs in resistance to torsional deflection, as extensive tests of scale models of thin steel have shown. Springfield has employed cast beds of this shape with excellent results. The angular webs are omitted near each end of the welded steel bed, and certain vertical webs at right angles to beam webs are used. This construction is partly for convenience in fastening mating parts.

Welds in the bed structure are made with an E-6016 (low-hydrogen) electrode to avoid underbead cracking. After the bed is welded, it is annealed to relieve welding stresses before any machining is done. Less metal is machined off than in cast beds. The ways are bolted in place and are ground to their final finish.

On shipboard, all machine tools are bolted to the steel deck. The deck plates are likely to be subject to considerable weaving, especially if the ship is bombed or struck by shells. Such stresses can warp any bed or fracture a cast bed unless some means to prevent this is provided. Although the steel bed has extreme rigidity and ability to take severe shock loads, it was clear that something capable of absorbing severe shocks and twisting stresses before they reach the bed would be a most desirable addition.

Leg Shock Absorbers

In the new Springfield lathe design, the two welded steel legs are made to absorb shock and to deflect when the deck weaves without transmitting the full twisting stress to the bed. This is true even though both legs are designed to be bolted firmly to the deck.

Let us consider first the tail leg, Fig. 5. This is fabricated from $\frac{5}{8}$-in. steel plate formed in rolls to a somewhat pear shape and flattened at the base. A $\frac{5}{8}$-in. oblong plate is welded to the top ends of the formed component, and at front and back a plate with a curved lower edge is welded to the top and two sides. A strip of 1 by 4 in. steel is welded at the center under the base to form a foot plate running from front to back. Four holes are drilled through both the base and the foot to allow the leg to be bolted to the deck.

The welded steel gimbals assembly is bolted to the top plate of the tail leg. Gimbals are a contrivance for permitting a body to remain level when its support is tipped. The transverse gimbals pin runs through the two bed beam webs and is fastened by snap rings. Short pins running longitudinally in the same plane fit into blocks welded to the base of the gimbals assembly. With this arrangement, no torsional stresses applied by the leg (as by deck weaving, for example) can cause a twisting moment on the bed. Moreover, the whole leg has a degree of flexibility because of the shape of the lower portion, which can act as a spring under vertical loading.

How Head Leg Is Built

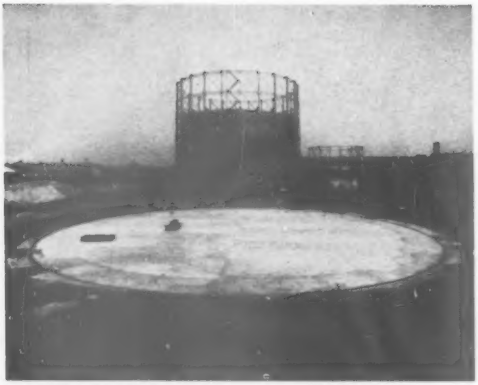
Design of the head leg is quite different. It constitutes a box in which the driving motor is installed and includes a top platform to which is welded the bed support plate. Bed rails are bolted to the platform after the two assemblies are completed.

Figure 6 shows the inverted leg and its reinforcements before the bottom has been added. Sides of the box are of $\frac{3}{8}$-in. plate, formed for a "wrap-around" with liberal radii at vertical corners. As reinforcements, two vertical channels of $\frac{3}{8}$-in. stock are welded to front and back walls.

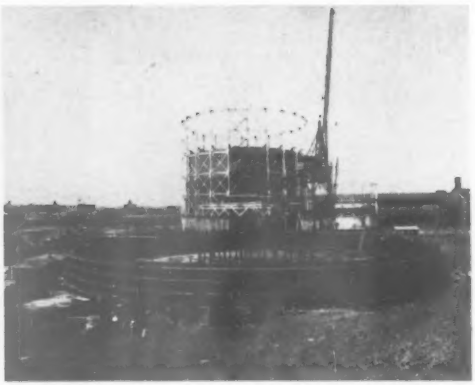
An opening in the outer end wall is left for access to the motor, which is suspended from a rubber bushing hinge attached to the underside of the platform.

The box constitutes a rigid structure save for its floor, which is made from four separate triangular plates of 1045 steel; these plates, in effect, constitute four leaf springs. Figure 7, a picture that was taken through the motor opening, shows the four leaf springs, each of which has a bolt through its centermost corner.

(Continued on page 42)

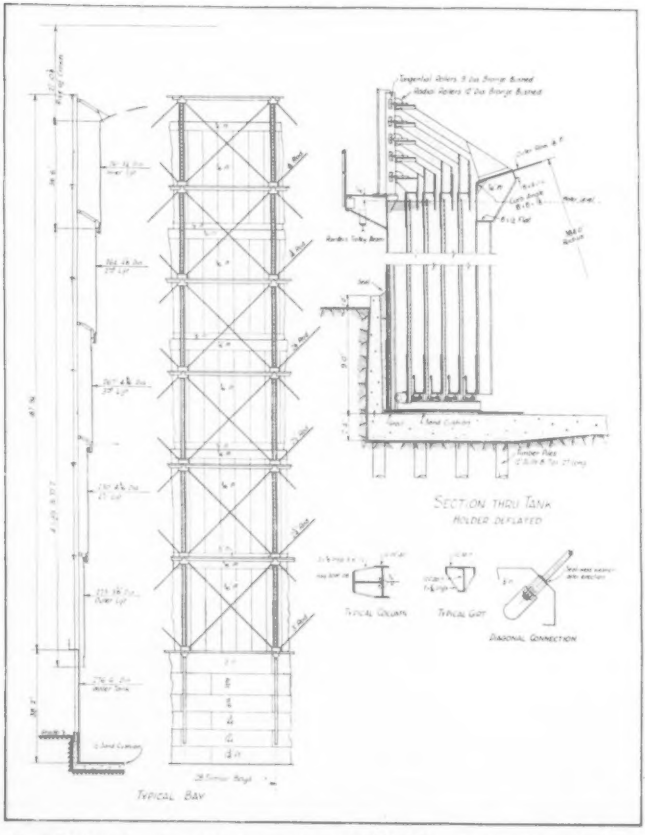


2—FOUNDATION SLAB, a disc 280 ft in diameter, has just been poured—an early stage in construction



3—BOTTOM of water tank has been completed, and four of the vertical tiers of side plates are placed

Toronto's All-



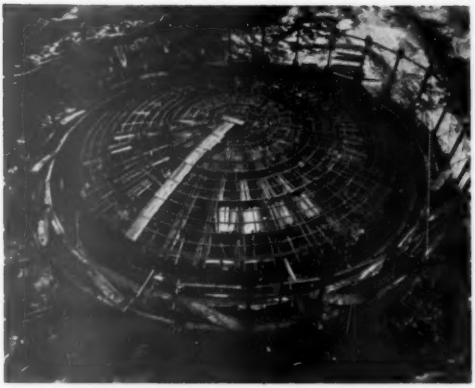
1—DESIGN details and features of the 10,000,000-cu-ft, five-lift gasholder

BY GEORGE F. KNIGHT
Plant Engineer, The Consumers' Gas Co. of Toronto, Canada

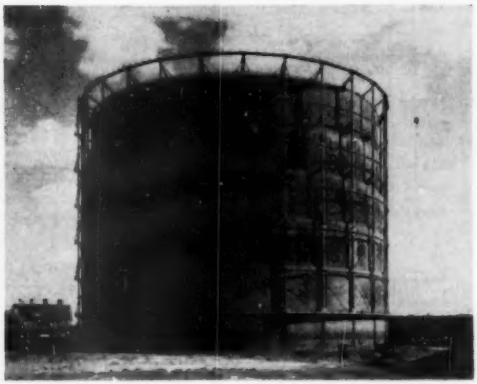
SOME two years ago it became apparent that The Consumers' Gas Company of Toronto would soon need additional gas storage. Business was increasing, and some of the existing holders were aged. The first decision we had to make was the type of holder to purchase. In our system we have seven holders, ranging from a counterbalanced single-lift holder in a brick tank to a four million cu ft waterless holder. We could, therefore, claim to have had some experience of the various types that have been accepted by the industry at large.

After discussions with other companies who had purchased holders in recent years and visits to many holder installations, we decided that the standard type of water tank multiple-lift holder offered many advantages and seemed best suited to our particular conditions. The design has been well proved over many years to be reliable in operation.

The possibility of purchasing this new holder in England was investigated. I found that the British gas industry has practically standardized on the spiral-guided type, which I do not consider suited to the rigors of our eastern Canadian climate. In Canada east of Vancouver, there is only one holder of this type, and I



4—TANK and five lifts are completed, one tier of guide framing is in place, but winter shut down work



5—FINISHED holder, largest of its type in Canada, is equivalent to the height of an 18-story building

Welded Gasholder

understand it is not used during the winter months because the formation of ice on the guide rails seriously interferes with its operation. The approximate prices obtained from the British for a column-guided holder were high compared with prices obtained elsewhere, and the promised time of completion was from four to five years in the future.

Detailed specifications and proposals were obtained from representative and experienced holder builders on this side of the Atlantic. In March, 1950, we entered into a contract with the Dresser Mfg. Co., Ltd., of Toronto, in association with Stacey Brothers Gas Construction Co., of Cincinnati, O., for the supply and erection of a 10,000,000-cu-ft, all-welded panel-type holder having a 17,000,000-gal water tank and an internal oil storage tank of 5,000,000 gallons (U. S.) capacity.

The main contractor sublet the providing of weldors and welding equipment to the Ideal Welding Co., Toronto. Under the direction of Dresser Mfg. Co. and our own inspectors, Ideal Welding was responsible for the qualifying, testing and training of weldors and for all the field welding involved.

The foundations were to be provided by us. We entrusted the designing and supervision of the building of the foundations to Proctor, Redfern and Laughlin, consulting engineers of Toronto, who were also given charge of inspection services during the erection of the holder.

The Holder Design

Figure 1 shows the main overall dimensions of the completed holder and also gives some of the design features that are peculiar to the application of the welding technique. This type of steel construction has clean lines, with a minimum of projecting surfaces to collect dirt and moisture. Corrosion is minimized, painting made much easier.

Another feature to make painting easier is the provision of beams for painters' trolleys under the tank walk and at the top of the guide frame. We feel that this small investment will soon pay for itself in reduced painting costs. Another novelty in holder construction is a mechanical means of removing snow from the crown.

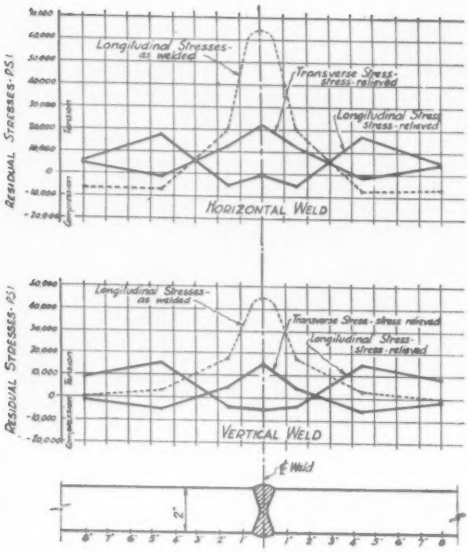
The overall height of the structure is equivalent to the height of an 18-story building. The holder proper has a capacity of 10,000,000 cu ft and comprises five telescopic lifts in a steel tank 276 ft 6 in. in diameter and 38 ft 2 in. from bottom to top. The framework extends 188 ft above the top of the water tank. The guide frame has 28 column bays, six tiers of horizontal girders and adjustable round-bar diagonals.

The water tank has a capacity of 17,000,000 gallons. It contains an annular ring 236 ft in diameter by 17 ft deep, within which can be stored 5,000,000 gallons of gas oil by floating it on top of the tank water. The entire structure weighs 3,900 tons, is of welded construction throughout and will be the largest all-welded water tank holder in Canada—so far as I can ascertain the largest of this type in the British Commonwealth.

Practially all the steel was obtained from Canadian mills. It was either fabricated in Toronto shops or was shipped direct from mill to construction site and fabricated in the field. It was necessary to go outside Canada for the cup and grip channels of the lifts, which weigh 136 tons and require special forming equipment not available in this country. Of the total money expended on the holder proper, however, 95% was spent in Canada.

Wherever practicable, large prefabricated units were assembled and welded in the shop and shipped complete to the job. In addition, many subassemblies were position-welded on the site, using jigs to assure accurate fit-up in the final assembly.

All welding was done by the metal-arc process, using the procedure set out in the Canadian Standards Association "Specification for Welding of Bridges, Buildings and Machin-



6—LEFT: "Before and after" stresses, 2-in. plate

7—ABOVE: Doing low-temperature stress relieving

ery." The completed structure has over 60 miles of welding and required 35 tons of electrodes. The amount of weld metal deposited per foot varied from 0.10 to 6.0 lb.

The tank shell plates are of ASTM A285 firebox quality steel. A joint efficiency of 85% has been allowed, resulting in a working stress of 17,750 psi. The welded joints that carry the highest stress are both X-rayed and stress relieved.

It was originally suggested to use an E-6016 (low-hydrogen) electrode to weld the heavy tank plates, but the contractor objected to this type of rod on the grounds of the extra cost and the unfamiliarity of the majority of his weldors with the different technique required. The final decision was to use E-6010 electrodes and carry out all work to satisfy the requirements of paragraph U-68 of the ASME Code for Unfired Pressure Vessels.

For the lifts of the holder and for the structural framing, E-6012 (d-c negative or a-c) electrodes were used.

Stress Relieving Studied

In the various codes covering allowable stresses in welded joints of pressure vessels, it is usual to find that higher stresses are allowed when the joints are stress relieved after welding. All available published information on the subject indicates that the residual weld stresses in thick plates are of considerable magnitude and can be considerably reduced by low-temperature stress relieving in the field.

Experiments carried out by Stacey Brothers Gas Construction Co. with the assistance of the Linde Air Products Co. were reported at the 1947 and 1948 annual meetings of the American Welding Society. In making these studies, test plates of ASTM A70 steel, 2 in. thick, 4 ft long and 6 ft 6 in. wide, were welded together to contain a horizontal and a vertical weld. Both welds were made under field conditions and simulating procedures used in the actual building of a gasholder tank. The residual stresses in the vertical and horizontal joints were measured by electric strain gages. Low-temperature stress relieving was then done by progressively and simultaneously heating both faces of the joints with oxyacetylene heads. A water spray was impinged on the plate 6 to 8 in. back of the flame to remove the excess heat and assist in the heating treatment.

Figure 6 shows graphically the results achieved by this method of stress relieving. The transverse stresses before stress relieving have been omitted in the interests of clarity. It will be seen that the maximum stress in the horizontal weld is 65,000 psi tension in a longitudinal direction before stress relieving. This is reduced to zero or lower (a small compressive stress) after stress relieving. The transverse stress in the same weld is 21,000 psi tension after stress relieving. In the vertical weld, the longitudinal stress is reduced from 45,000 psi tension to 5,000 psi compression.

Figure 7 shows the method of stress relieving as applied to the particular holder under discussion. Bands 6 in. wide were progressively heated by an oxyacetylene torch on both sides of the weld while a water spray impinged 6 to 8 in. back of the advancing flame. Note the vertical reference marks at 6-in. and 12-in. intervals. The purpose of these marks is to coördinate the treatment on the two sides of the plate. The inner and outer torches must be approximately opposite when stress relieving welds in thick plates.

Stress relieving was carried out on all vertical welds in the first and second tiers, throughout the entire longitudinal (circumferential) weld between the first and second tiers and 18 in. along the second circumferential seam from the point where it intersects the second vertical seam.

Inspection and Testing

I felt that independent inspection of the work in the early stages of construction would be advantageous.

Accordingly, the services of a qualified full-time inspector and an assistant were engaged. They visually inspected all welding while it was in progress and checked on the qualifications of the individual weldors that had qualified for this type of work with the Canadian Welding Bureau. They also examined all X-ray plates made of welded seams in the water tank.

All full-penetration welds in the water tank were inspected by means of a portable X-ray machine. Over 500 individual X-ray pictures were made. On partial penetration welding, where X-raying could not be done, samples were cut out of the seams and examined visually. However, we kept the number of sections removed by trepanning to the absolute minimum as we felt that perfect welding might be removed by this method of inspection, while no check is made later of the welding done to repair the section removed.

The examination of the welding done on the critical part of the tank proved very gratifying. Only 39 in. of welded seams had to be repaired, and 36 in. of this was on the borderline and possibly acceptable.

Every inch of every seam in the tank bottom was checked for tightness by the use of a vacuum box. This box has a heavy gasket on the bottom and a plateglass top. Soapy water is brushed on the seam and the box put over it. A vacuum pump then exhausts the air. Any leaks show up as bubbles, just as they would when mains under pressure are tested with soap and water.

To check the welding in the vertical lifts, we inflated the holder with air and painted every seam for its full length with a soap-and-water mixture. An insignificant amount of repair work was required. The crown or dome of the holder was similarly checked and was found to be tight, no repairs at all being necessary.

Design Data, Foundations

The structure and foundations are designed for a wind pressure of 26 lb per sq ft of exposed surface when the holder is fully inflated and for a simultaneous unbalanced snow load of 5 lb per sq ft on half of the area of the crown. These two live loads could result in a pressure at the foundation line of 2,930 lb per lineal foot of circumference. The dead load, resulting from the steel in the guide framing, stairs, tank shells, etc., amounts to 3,490 lb per lineal foot. The foundation thus has to bear a total combined load of 6,420 lb per lineal foot.

Before designing the foundations, or even deciding on the type of foundation to be used, five test borings were made on the site of the proposed holder. Bed rock was encountered at slightly varying depths, 32.8 to 36.7 feet below ground level.

Two soil loading tests were made on the yellow clay, which the borings showed generally to prevail over the entire site at this grade. The results indicated the bearing value of the soil to be adequate for a load of 4,500 lb per sq ft. Since each of these tests was made on only one square foot of ground, however, and the foundation for the holder covers over 61,500 sq ft, it was not felt prudent to assume that all parts of the site would have bearing values as high as those obtained in the tests. In order to be sure that there would be no settlement or tilting of the main slab, it was decided to design for a piled foundation and carry the impressed loads down to solid rock. Various types of foundation piles were considered, including precast concrete, patented concrete, concrete-filled steel shells and timber. Steel shells were not considered acceptable due to the possibility of corrosion of the steel from subsurface waters. Most of the various types of concrete piles would have to be imported whereas timber piles could be obtained in Canada at low cost. Therefore, timber piles were adopted.

The bottom of the water tank was located at about 8 ft below the yard level. This arrangement has its advantages: the ground acts as an insulator to the water in the lower part of the tank, thus reducing the amount of heat required to prevent the water from freezing in the winter.

The main foundation slab (Fig. 2) is a reinforced-concrete disk 280 ft in diameter and varying in thickness from 20 to 28 in. The first 242 ft of the circle have 20 in. of concrete; the outer ring continues at 28-in. thickness. The slab is reinforced with $\frac{5}{8}$-in bars top and bottom in the 20-in. center and $\frac{3}{4}$-in. bars top and bottom in the 28-in. portion.

The following work was done in connection with the foundation:

35,000 cubic yards of earth removed.

4,810 piles driven to rock.

132,000 feet of timber piling placed.

250 tons of reinforcing steel placed.

4,453 cubic yards of concrete poured.

Erection Details

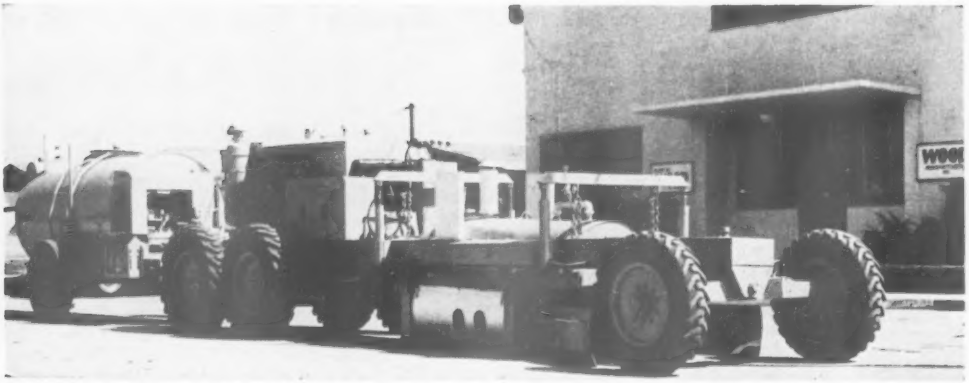
Though the foundations were completed by June 19, 1950, it was not possible to commence erection of the steel until July 3, 1950. Preparatory to the construction of the tank bottom, the top of the concrete foundation slab was covered with a layer of sand sprayed with oil; the bottom plates of the water tank were then placed on the sand and welded together. By the end of August, the bottom was not only completed but four of the vertical tiers of side plates were in place, as shown in Figure 3.

One of the contractor's big problems in the construction of gasholders is to insure that the tank will be circular when completed and will have truly vertical sides. Unless this is achieved, the telescopic lifts will not function properly, the holder will not operate without binding and there will be buckles and distortion in the platework. Many ingenious methods of positioning the tank sides both circumferentially and vertically have been developed.

After the tank was completed, the lifts were erected inside the tank and on the rest blocks; we started with the outer lift and worked inwards to the inner lift. Rapid progress was made on this part of the job as large panels of the lifts had been subassembled continuously throughout the earlier stages on large concrete platforms. The subassembly platforms were specially built for their purpose adjacent to but outside of the holder.

A stiff-leg derrick handled the heavy sections and large plates around the subassembly tables and picked up the finished components and stacked them along the outside of the tank shell. From here, they were picked up by the boom of a trammel derrick working inside the tank. This trammel had a radius of 113 ft; its pivot point was on the center tower of the permanent frame and the other end was supported on

(Continued on page 37)



1—MODEL 42 "road mixer" with 1,500-gallon welded tank trailer standing in front of the Wood Mfg. Co. main office

Building for Road

It would be hard to find a business more dependent on arc welding than is the Wood Manufacturing Co., the originator of "Mix-in-Place" roadbuilding machinery.

BY FRED M. BURT

As an example of how arc welding is being applied to the manufacture of heavy-duty road-making equipment, let's look at the Wood Manufacturing Co., North Hollywood, Calif.

What It Makes

The plant's current production is principally on the following items:

Model 54, a tractor-drawn, single-pass "road mixer" with a capacity of 350 tons per hour. In an eight-hour day, it can lay one mile of 24-ft roadway, 3 in. thick. Length: 27 ft 10 in.; width: 8 ft 1 in.; height: 6 ft 9 in.; weight: 17,500 lb.

Model 42, a self-propelled, single-pass road mixer with a capacity of 200 tons per hour or ¾ of a mile of roadway daily. Length: 27 ft 6 in.; width: 8 ft 0 in.; height: 8 ft 6 in.; weight: 22,650 lb. A fully rigged Model 42 mixer with its trailing tank is pictured in Fig. 1.

Model 36, self-propelled, single-pass road mixer with a capacity of 150 tons per hour or ⅜ of a mile of roadway daily. Length: 29 ft 0 in.; width: 8 ft 0 in.; height: 7 ft 5 in.; weight: 18,880 lb.

Model P-600, a Diesel-powered, self-propelled "preparizer" that makes cuts 6 in. deep in old asphalt roads being resurfaced. It will dig up to a mile a day. As a soil blender, it cuts 8 in. deep at a rate of 1,000 cu yd per hr. Length: 17 ft 3 in.; width: 8 ft 6 in.; height: 8 ft 0 in.; weight: 13,490 lb.

Model PT-600, tractor-powered "preparizer" that will cut 12 in. deep in soil blending at a rate of 2,000 cu yd per hr. Length: 17 ft 3 in.; width: 8 ft 6 in.; height: 5 ft 0 in.; weight: 9,490 lb.

Spreader box, purpose of which is to measure materials as they are emptied from the trucks and place them in accurately proportioned windrows of 2 to 8 cu ft. Length: 5 ft 0 in.; width: 10 ft 11 in.; height: 3 ft 2 in.; weight: 2,000 lb.

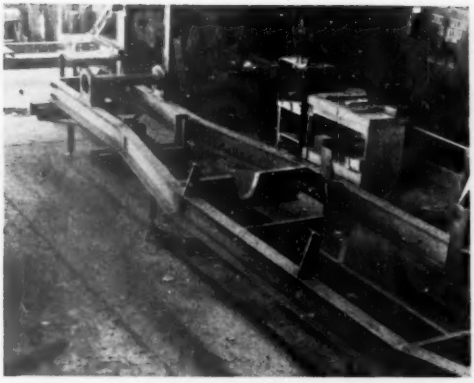
Windrow proportioner, to measure and form materials on road bed into accurately proportioned windrows in one to three passes. Length: 15 ft 2 in.; width: 7 ft 5 in.; height: 5 ft 11 in. Weight: 2,200 lb.

Tank trailers and cement distributors are also manufactured.

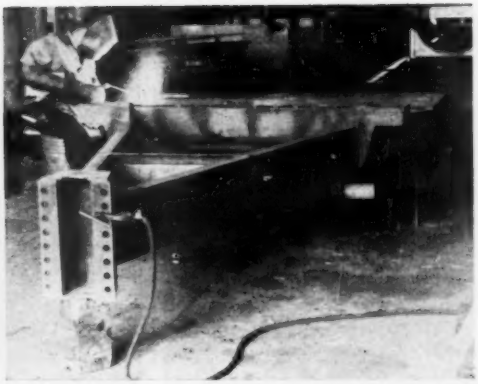
4—WELDED cases house rotor-drive transmission and transfer units for Models 36 and 42 road mixers. If these cases were made of cast iron, expensive patterns would be required and outside procurement would cut down the plant's self sufficiency

Building the Frames

A variety of structural shapes are used in building the frames of all the



2—MAIN FRAME of the Model 42 is an all-welded job



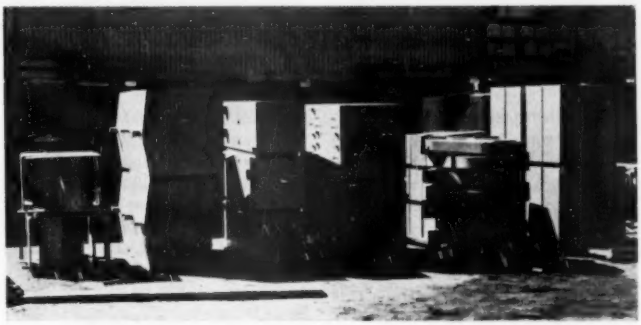
3—WELDING a main frame for the P-600 "preparizer"

building

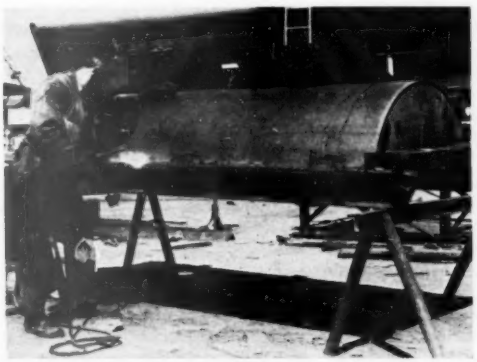
machines. The main frames of the various self-propelled mixers are fabricated from I-beams. Figure 2 shows the welded main frame of the Model 42 road mixer. (Frames for the 54 and 36 models are similar but vary in length.) Like all Wood's frames, this frame is fitted and jig welded in an inverted position. Welding is done upside down to facilitate attachment of brackets and the equalizer axle and support.

Wherever possible, the jigs are made from structural members without unnecessary attachments. The Model 42 frame jig is made of a number of 6-in. channels welded together. Locater stops, also of 6-in. channels, are welded to the various arms to insure uniformity of the frame. The frame side members are held in place by chains and "come-alongs." Leveling jacks are fitted to the jig to eliminate distortion.

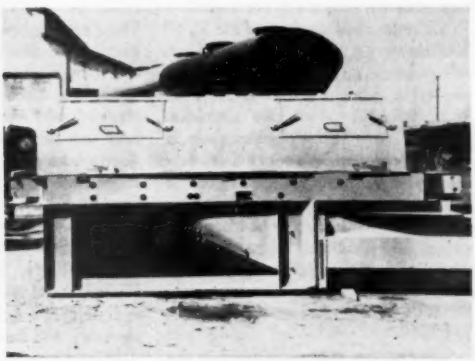
It will be noted in Fig. 2 that the frame member has four offsets. These were made without cutting the web of the frame. Depending upon the direction of the offset, there was either a straight cut or a vee section



5—IN STORAGE yard, left to right: motor and air receiver tanks; Diesel fuel tanks; gasoline-Diesel fuel compartment tanks; more Diesel fuel tanks (different view); welded chain cases; fuel tanks for a "preparizer"



6—ARC WELDING a lid for the mixing drum of the Model 54 road mixer. Drum is formed of ¼-in. plate



7—COMPLETED mixing drum is 80% weld-fabricated; note the dogs that are used to hold the lids in place

8—PADDLE plates for the mixing drum are hard-faced for long wear

9—WEARING AREAS of helical screw feed of mixer drum are hard-faced with a self-hardening alloy of high abrasion and good impact resistance

cut from the upper and lower flanges. The web was then heated and bent the desired amount, after which the flanges were rewelded.

Upon completion of the job, the frame is inverted to its rightful position, and numerous pipes, plates, angles and bars are welded in place. These attachments function either as a working part of the machine or serve as a support for such parts.

The frame of the P-600 preparizer (Fig. 3) is constructed almost entirely of rolled channel sections and plates. In some instances formed plates are flame-cut to provide attachment brackets and stiffening webs. Care is exercised in the cutting operation to insure the minimum of scrap. Often it is possible to prepare right and left-hand brackets simultaneously by diagonally cut plates.

In the fabricating shop of the Wood Manufacturing Co. plant, the welders are mounted on brackets and raised above the floor. This keeps the floor area clean for production activities. Because the welding machines are in these "inconvenient spots," the operators tend to exercise greater care in machine settings. Since it is difficult to change his machine setting, the weldor sees that it is correctly maintained to insure satisfactory welding.

Welded Transmission Case

Some of the weldments used in the road mixers are quite complicated. An example of this is the rotor-drive transmission and transfer cases for the 36 and 42 models (Fig. 4). These cases could be of cast iron, but for many excellent reasons Wood has used weldments. Cast-iron cases, for instance, would have to be produced outside the Wood plant. This would cut down the plant's self-sufficiency and might result in production delays in such times as these when foundry production is carrying peak loads and the material situation is critical. Pattern costs are also a factor; design changes would be very expensive with the cast-iron unit, whereas new drawings and templates for flame-cutting machines are all that is necessary to change the design of the welded unit.

All component parts of the transmission cases are flame-cut automatically by multiple-torch machines. They are formed from 1 in., ¾ in. and ½ in. mild-steel plates and are arc welded manually. All of the flat welds are made with ¼-in. E-6020 electrodes. Fillet welds on the corners are made with 3/16-in. E-6012 electrodes; 5/32-in. E-6010 electrodes are used around the circular ends of the cases.

After welding, these cases are normalized at about 1,400 F and allowed to cool slowly. They are then sandblasted, faced, bored for bearing fits and drilled for the bolts needed in assembly and installation.

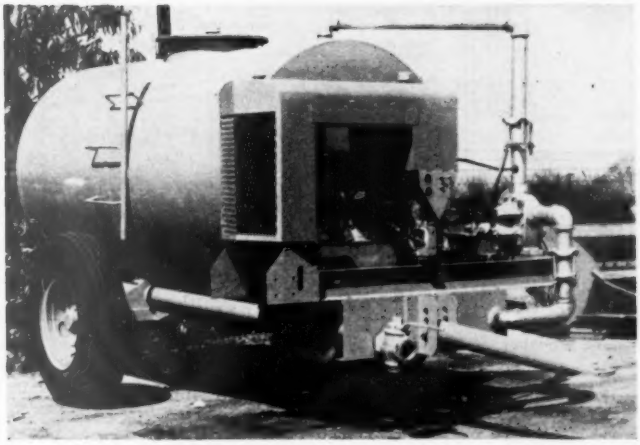
* * *

To illustrate the full extent to which welded parts are used in the building of road mixers it might be well to take a trip to the storage yard. A group of various fabricated components is pictured in Fig. 5. Moving from left to right, we first see the motor and air receiver tanks, then the Diesel-fuel tanks followed by the gasoline-oil compartment tanks that supply fuel for the burners and oil for the hydraulic operating units. The next items are Diesel-fuel tanks (seen from a different angle), adjacent to which is a stack of fabricated weldments used as chain cases on the model 54 mixers. Needless to say, these cases are oiltight. The final tanks at the extreme right were built to hold Diesel fuel for the P-600 preparizer.

Making Mixer Drums

Let us look at another part, the mixing drum for the road mixer. It is fabricated from ¼-in. mild-steel plate rolled to form. Here again a jig is used to insure uniformity. It should be noted that the dogs that hold the mixing drum at its jig (Fig. 6) have been arranged so that a dog of similar type can be used to hold the lid on the completed mixing drum (Fig. 7).

The mixing drum mixes soil, asphalt and other ingredients required in the building of good roads. It is subjected to extremely severe abrasive wear, especially the paddles that do the mixing. The paddle plates are made of 4 by 6 by ¾-in. heat-treated



10—WOOD 1,500-gallon tank trailer is an all-welded product except for the wheels and threaded piping. The frame, axles and tank are welded

plow steel. To prolong their life, a self-hardening type of hard-facing is deposited along the places subject to extreme wear (Fig. 8).

Hard-facing also serves an excellent purpose on the helical feed screw of the mixing drum. An alloy of high abrasion resistance is deposited along the outer edges of the replaceable blades of this feed screw (Fig. 9).

Welded Tank Trailer

The 1,500-gal tank trailer pictured in Fig. 10 is completely welded with the exception of its threaded piping and the auxiliary piping equipment. This trailer is used in connection with the road mixer. Mounted upon its all-welded axle and main frame are a welded tank, pump frame, fuel tank for the pump engine and other items. Welding and flame-cutting also provide a flexible tongue to hitch the trailer to the road mixer.

Another item with a welded frame, tank and other parts is the cement distributor. This piece of equipment is used to apply quantities of bulk cement to the windrow prior to mixing for a soil-cement stabilized base. In the actual building of a road, the cement distributor is followed by the road mixer with a laydown attachment. The road mixer gobbles up the windrows of mixed soil and cement and adds water to complete the mixture. This material is then dumped and spread along the road by a vibratory spreader. The mixed material is compacted to 50-60% compaction to insure another smooth road.

Plant and Equipment

The Wood Mfg. Co. plant is located on a 13-acre site in the middle of that part of the San Fernando Valley that lies within the city limits of Los Angeles. There are upwards of 50 production workers, including 18 weldors and flame-cutting operators.

The main building, devoted to layout, cutting, welding and assembly, is 160 ft long by 100 ft wide. The center section, 160 ft long, is served by a 10-ton bridge crane, and the two side areas have 3-ton bridge cranes.

The welding and cutting equipment includes a three-torch shape-cutting machine that can handle plates up to 60 in. wide by 12 ft long, a portable straight-line and circle cutting machine, 15 hand torches for cutting and welding and 16 d-c motor-driven welders. In addition, there are several other welders in reserve and two 300-amp welders in the equipment repair yard of an allied company, Clyde Wood & Sons, which also has six gas-engine-driven welders out on construction jobs.

Separately housed away from the main building is a 150-lb acetylene generator with pipe connections to 16 stations located at various strategic points. Oxygen is supplied from banks of one to four cylinders.

ALL-WELDED GASHOLDER

(Continued from page 33)

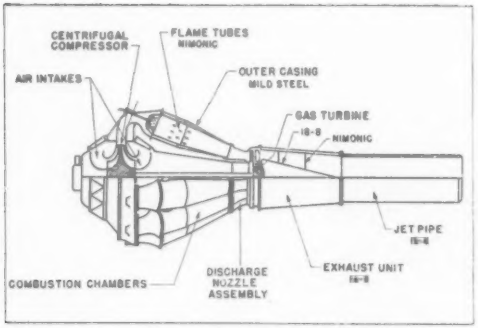
an A-frame running on a circular track on the holder bottom. On top of the trammel beam was mounted an 85-ft boom. All tank and lift plates were erected quickly and with the minimum of effort by means of this equipment.

Closed Down for Winter

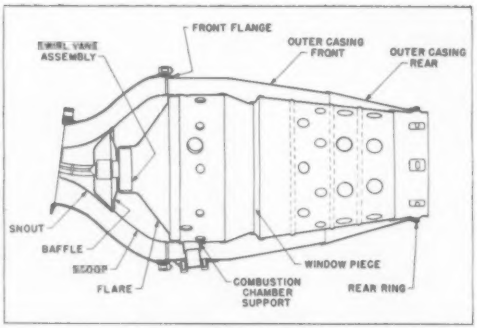
A great deal of erection time was lost during the summer because of the unusual number of days on which it rained. During the fall the weather became worse, and we finally agreed with the contractor to suspend work until the spring of 1951. It was becoming increasingly difficult to hold weldors on the job, and the output per man was becoming steadily smaller. Also, the quality of the work was suffering because of the difficulties caused by having to weld cold steel. The job closed down temporarily at the end of December. Necessary precautions were taken to insure the safety of the structure during the winter. The trammel derrick was dismantled and removed, and as much equipment and material as possible was stored inside the tank. The space between the bottom of the tank and the top of the concrete was temporarily sealed with mastic to prevent rain and melting snow from washing out the sand cushion.

Figure 4 shows the condition of the tank at the time of closing down. Considerable progress had been made. The tank and five lifts had been completed; most of the permanent frame and oil ring had been erected, and one tier of guide framing was in place.

Work was resumed at the beginning of May, 1951, and continued throughout the summer. The contractor expected to have his work finished and all tests completed in time to turn the holder over to us in July, 1951, but he encountered delays that moved this date forward to October, 1951. During the second week in October, all work had been completed, and the holder had been run up and down several times to see whether or not the framework was plumb and the various lifts correctly adjusted with one another. Figure 5 shows the appearance of the project during the final tests.



1—HERE ARE the principal components and how they are arranged in a gas-turbine unit for jet propulsion



2—COMBUSTION chamber. Resistance welding helps fabricate the various cylindrical and conical parts

Welding the High-Heat-Resistant *Materials**

Alloys capable of withstanding service temperatures around 1,800-1,900 F naturally introduce welding problems. Here is what one authority has discovered.

BY J. L. SOLOMON
Research Director, Sciaky Bros., Inc.

THE development of the jet-propulsion gas turbine demonstrated the importance of the various welding processes such as fusion and resistance welding. The jet engine, unlike the reciprocating type of engine, is constructed largely of sheet metal. The sections are either rolled or pressed to the proper shape. Engines for aircraft have heretofore been fabricated by methods of machining and fabricating heavy castings, forgings and rolled sections. Now it is welding that is of prime importance.

Some Jet Parts

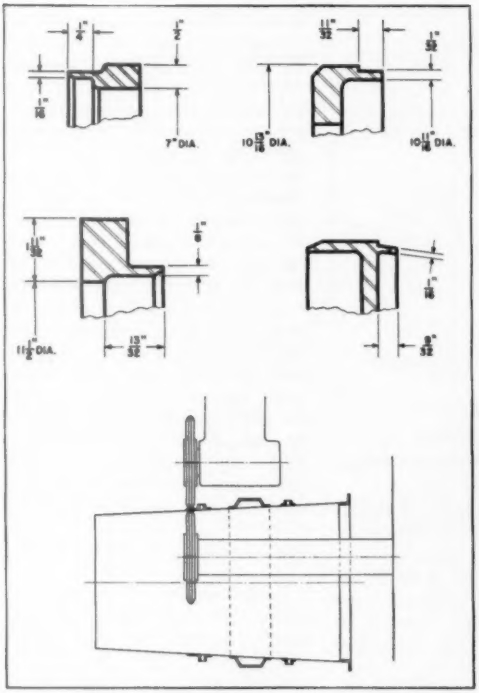
Figure 1 illustrates a typical arrangement of parts in a gas turbine unit utilized for jet propulsion. A series of combustion chambers are arranged to receive the air and fuel from the air intakes and centrifugal compressor and to discharge the gases into the exhaust unit and out the jet pipe. Each combustion chamber (Fig. 2) consists of a number of sheet-metal parts of cylindrical and conical shape, fabricated by resistance welding. These components of the combustion chambers include the burner, flame tube head, air casing and the discharge nozzle.

The air casings operate at low temperature and are normally fabricated from mild steel having a sprayed aluminum coating to prevent oxidation. The flame tube undergoes extremely high temperatures and is of a nickel-base alloy such as Nimonic 75. The flame tube head is made from a number of pressed or drawn parts, which are stitch welded together. The body of the flame tube is made from drawn sections, seam welded together.

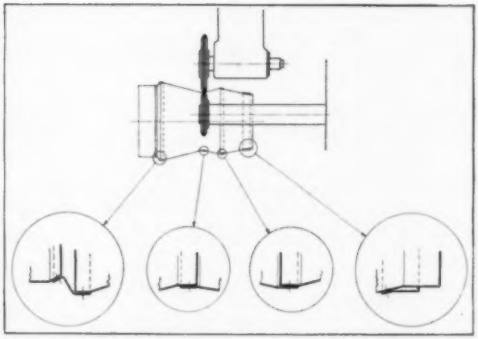
Between the combustion chambers and the turbine is the discharge nozzle assembly, which consists of nozzles of austenitic steels welded to heavy machined flanges of a tungsten-bearing austenitic steel. The exhaust unit, lying immediately behind the turbine, consists of an outer truncated cone made of 18-8 stainless, which is seam welded to a machined flange at each end. An inner cone is supported from the outer cone by tubes which are shielded from the high velocity gases by air foil sections. These air foil sections are constructed of a Nimonic 75 outer skin, and they are spot welded to inner spacers of 18-8 stainless. The welding of the outer skin to the inner spacers is done by a series resistance-welding process.

The jet pipe behind the exhaust unit, from which the high-velocity gases emerge, is peculiar to the installation of the jet engine in each particular airframe. For this reason, it is designed and constructed from a variety of materials—18-8 stainless steels of stabilized types 347 and 321, super-stainless steels such as 19-9DL and, in one particular case, from that material of the future—titanium. Both circular and longitudinal seam welding, as well as spot welding, is utilized in the construction of the jet pipe. The titanium jet pipe is being seam and roll-spot welded on three-phase machines, and it is interesting to note that the techniques used for welding titanium are quite sim-

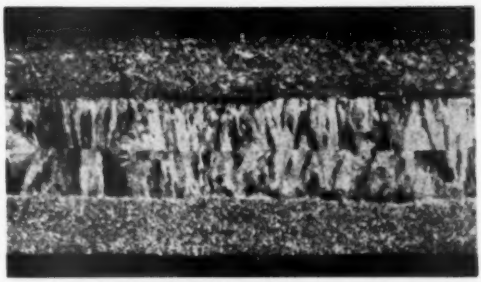
*Abstract of a paper presented Oct. 14 at the 32nd AWS convention, Detroit.



3—JOINTS for Nimonic and stainless-steel sheets



4—WELDING Nimonic sections of flame tube. Maximum thickness welded is 0.064-in. to 0.064-in. sheets



5—CROSS-SECTION of a stitch weld in Nimonic 75

ilar to those used for welding stainless steels.

Materials for Jets

The materials used in jet aircraft construction include mild steel, austenitic stainless steels, martensitic stainless steels and nickel-base alloys. Physical properties are given in Table I. The stainless and high-nickel alloys (such as Nimonic) are characterized by their high electrical resistivity, low thermal conductivity and high tensile strength. These properties will affect the methods utilized in resistance welding and will govern the type of welding schedules necessary to produce high-quality welds. For example, a certain joint in an afterburner had been originally seam welded. The fatigue life was increased substantially by using an intermittent-drive overlapping roll-spot weld, and this at an increase in welding speed.

In considering the welding parameters† required for welding high-heat-resisting alloys, the welding force is determined by the high tensile strength of such materials and by the ability of these materials to retain their tensile strength at elevated temperatures. Thus, the welding force is relatively high in comparison with that used in the welding of mild steel. On the other hand, the high resistivity of the material limits the current density to a lower value than that used for mild steel and other materials of better electrical conductivity.

Low Thermal Conductivity

The third property that differs from the materials most commonly welded is thermal conductivity. Because of low thermal conductivity, the weld must be maintained under the electrode force for a sufficiently long time to permit it to cool to a stable temperature, and sufficient cooling must be provided so that the weld will reach such a temperature quickly. The property of low thermal conductivity also demands that sufficient cooling be provided in a seam-welding operation to achieve a uniform starting condition for each weld.

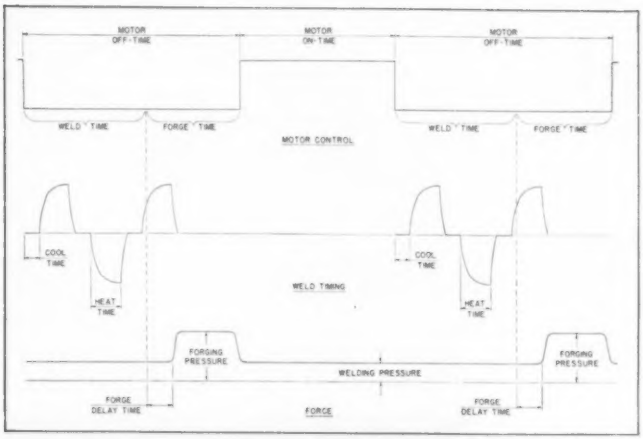
Frequently, the problem of joining materials having different rates of thermal conductivity is encountered in jet engine manufacture. In this case, a thermal balance is achieved by proper selection of electrode dimensions. In many instances, it is necessary to use two different electrode materials as well in order to provide proper thermal balance.

Figure 3 illustrates a number of flanged sections that are seam welded to cylinders or truncated cones formed from sheets of various thicknesses and alloys.

Figure 4 pictures a typical weld in Nimonic material, required in the fabrication of the flame tube of the combustion chamber.

The weld in Fig. 5 is a cross-section of a typical stitch weld in Nimonic 75. The stitch welding process is encountered a great deal in jet engine design because of the necessity of producing pressure-tight joints on very small diameters. In stitch welding, it is important that the pitch of the welds be kept as uniform as possible and that adequate external cool-

†Parameter—an independent variable, through functions of which other variables may be expressed.



6—OPERATING sequence for seam welder doing intermittent roll-spot welding

ing be provided. Perforated tubing, formed in an annular ring around the electrode, is generally used for external cooling.

Small Overlaps Provided

Remembering the high velocity of the gases that pass through a jet engine, it is clear that electrode indentation must be kept to a minimum in order to maintain good aerodynamic surfaces. The use of variable pressure in welding aids in reducing indentation and sheet separation. Because of the unique requirements on the design of jet engines, the overlap provided for resistance welding is usually much less than what would be desired. For this reason, extreme care must be taken to avoid expulsions of material. Rigid controls must be placed on the maintenance of electrode tips to provide proper contour and assure correct size of the weld nugget.

In the sheet thicknesses normally encountered in jet engines, a weld nugget of four times the sheet thickness is considered optimum. In some instances, edge distances as low as 0.060 in. have been used in production successfully; greater edge distances are preferred, however, for ease in manufacturing.

Most high-heat-resistant alloys are stitch welded with a current density of 250,000 to 300,000 amperes per square inch and a force density of 25,000 to 35,000 psi.

The seam welding of high-heat-resistant materials ranging from 0.020 to 0.064 in. may be effected by utilizing a heat time of up to eight cycles with a cool time of twice the "on" time. Current densities of 300,000 to 350,000 amperes per square inch are utilized with pressure densities of 40,000 psi. The welding of this material in thicknesses below 0.062 in. may be accomplished satisfactorily by using a straight seam welding process. In gages above 0.062 in., it has been found advantageous to use an intermittent seam welding process. Instead of the wheels rolling continuously, as in straight seam welding, they are allowed to advance only during those periods when there is no passage of current.

After the preset wheel force is established, the foot pedal is depressed, bringing the head down upon the pieces to be welded. The first pulse of welding current (or series of welding current pulses) is passed through the material, after which the material is forged by an increase in pressure. After a preset forging time, the pressure is lowered and the wheels are allowed to advance to the next spot. Fully electronic controls regulate the welding current, the forging pressure, the forging delay and the d-c motor.

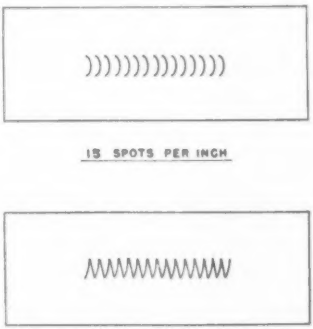
Figure 6 is a diagram of the sequence of operation.

Some Welding Problems

In the seam welding of Nimonic, it is very important to maintain the number of spots per inch. In one seam welding operation, the optimum number of spots per inch was found to be 15. With less than 15 spots per inch, either no weld was obtained or the weld was cracked—in some cases discontinuous. If the wheel speed is decreased to give more spots than 15 per inch, the welding pattern takes on the zig-zag appearance shown in the lower part of Fig. 7. This is probably because the second weld is shunted so much by the first weld that only the corner of the weld nugget which has the least pressure density will weld. The next weld will obtain higher current at this end of the weld because of the lower shunt effect, and will therefore produce a weld at this point. The next welded point will be at the opposite end and so on, with the result that the pattern will have the typical zig-zag characteristics. With a slight increase in wheel speed, the shunting effect is minimized and a regular pattern may be obtained.

Small Overlaps, Narrow Flats

In seam welding, the electrodes are machined flat to the width of the weld nugget required. The width of the weld nugget is determined by the available space on the flange, which, of course, has been predetermined in the design of the engine. Because narrow flanges are designated in the design, the weld nugget is very often smaller than one would desire. To obtain satisfactory welding, it is necessary to machine the wheels with a narrow flat and to maintain the width of the flat very carefully. The electrodes utilized are usually the Class 3; however, in certain cases where dissimilar metals are being welded, it may be necessary to use dissimilar



7—PATTERNS of seam welds vary with the number of spots per inch

Table I. Physical Properties of High-Heat-Resistant Materials

AISI No.	Type of Material	Specific Heat Btu/°F/lb 0-200 F.	Thermal Conductivity Btu/ft²/hr/°F/in. (68-212 F)	(See Note 1) Mean Coefficient of Thermal Expansion in./in.°F x 10^{-6} 68-212 F	68-1,825 F	(See Note 2) Electrical Resistivity at 68 F (Microhms/cm³)	(See Note 2) Electrical Resistivity at 1,200 F (Microhms/cm³)	Ultimate Strength, psi (min.)
1010	Mild steel	0.107	460	6.5	7.8	10		45,000
1022	Mild steel	0.107	460	6.5	7.8	10		55,000
410	Hardenable chrome-steel	0.11	173	5.1	7.6	57	108.7	60,000
321	Titanium-stabilized stainless	0.12	113	9.6	11.2	71		75,000
347	Columbium-stabilized stainless	0.12	113	9.6	11.2	71		75,000
310	25-20 stainless	0.14	90	8.0	10.6	80	115	80,000
316	Molybdenum-bearing stainless	0.12	113	9.6	11.2	73.0	116.0	80,000
Nimonic 75	20% chromium—80% nickel			8.4	15	110		84,000 to 100,000
Nimonic 80	20% chromium—74% nickel							
Inconel X	15% chromium—73% nickel	.11	106	7.6	9.2	122	131	110,000

Note 1—The coefficient of expansion for low-carbon iron is 6.5 range 68-212 F; 7.8 range 68-1,832 F.
Note 2—To obtain resistivity in ohms/circular mil foot, multiply microhms/cm³ by 6.017

alloy electrodes in order to produce proper heat balance. Furthermore, the design of the electrodes is dependent upon the thickness and thermal conductivity of the material being welded. In preparing for seam welding, it is very important that the surface of the material be thoroughly degreased. On those materials which have undergone a heat treatment, a very heavy and adherent scale will cover the parts. This scale has a very high resistance and must be removed by pickling.

The wide range in overlap of material and the dissimilarity of the materials being welded make it necessary to study each weld section individually to determine the largest weld nugget that may be obtained at that section, and then determine the pressure and current that would be required to produce a good weld. Here are some specific examples:

To weld 0.031-in. to 0.043-in. Nimonic, an upper electrode 10 in. in diameter with 0.312-in. flat and a lower electrode 6½-in. in diameter with 0.250-in. flat were utilized. The overlap was 0.750 in., and the resulting weld nugget was 0.200 in. wide.

Another welding problem was the welding of 0.062-in. plus 0.062-in. Nimonic with an overlap of only 0.405 in. In this case, the same electrodes were used, and the weld nugget diameter was 0.250 in. Because of the small overlap, this welding operation would tend to be more critical than the former since the edge distance from the weld is less than 0.075 in., whereas in the former case, the edge distance was 0.275 in.

Still another example is the welding of 5615 material, 0.040 in. thick to Nimonic 75, 0.031 in. thick. The overlap in this case was only 0.355 in., and the electrodes were reduced to 0.218-in. flat for the upper electrode and 0.187-in. flat for the lower electrode in order to confine the weld. Due to the small overlap, this welding operation is still more critical.

Single-Phase vs. Three-Phase

In early experience, single-phase welding equipment was used exclusively for the manufacture of jet engines, and it was found that it was quite difficult to obtain consistently high-quality welds in production operation, especially on those jobs having narrow overlaps and in joining high-heat-resistant alloys. Due to the high resistivity and low thermal conductivity of the material, the build-up of current in the spot when single-phase was utilized was so rapid that the localized spot temperatures were extremely high and expulsion of material resulted. Since the rapid increase of current during the first half cycle produces expulsion of material, it is necessary to hold the pressure density and current density between very close limits in order to obtain satisfactory welds. Furthermore, the high current density at the edge of the welding electrodes (due to skin effect phenomena) produces increased heating at the edges of the electrodes, causing mushrooming of the electrodes. At the English Rolls Royce plant, where the Nene engine was developed and first produced, they were unable to obtain more than 36 ft of welding before changing the electrodes used in the seam welding of 18-8 or Nimonic of 18 gage. In the welding of thinner gages, 21 to 24, an electrode change would be required after 180 ft of welding.

When production started in the United States on the same engine, the manufacturer installed both single-phase and three-phase welding equipment on his production line. It was found that there were definite advantages in the use of the three-phase equipment. For example, the matter of edge distance and overlap lost their importance, and it was found that with the three-phase equipment edge distance of 0.060 in. from the periphery of the tip to the edge of the sheet could be tolerated. Furthermore, because of the decreased skin effect phenomena, there was less tendency for the electrodes to mushroom. Several thousand spots may be obtained in the spot and stitch welding of Nimonic and 18-8 stainless steel. The average length of life of a

set of electrode wheels, when welding 0.043-in. plus 0.048 in. Nimonic, is approximately 350 ft.

Shunting Effect

Another important factor is the matter of shunting effect. Because of the high resistivity of the materials used in jet aircraft, the resistance of the spot being welded is high in proportion to the total impedance of the circuit having this resistance. However, the adjacent spot has a pronounced effect upon the distribution of current through the previously welded spot and the spot to be welded. Without shunting, the resistance of the material being welded may be equal to the short-circuit impedance of the throat and transformer of the welding machine; however, because of the higher impedance of the secondary of the single-phase machine, a change in the resistance of the load does not effect, to any great degree, the total current passing through the secondary circuit. Therefore, when a previous spot exists close to the spot being welded, a great percentage of the current is shunted to the previous spot and there is not sufficient current through the second spot being welded to produce a weld.

To produce a weld for the second spot, it is necessary to increase the secondary current by changing the tap or changing the setting of the heat control. If the spacing between the first and second spot varies, it becomes quite difficult to compensate manually for the change in the distribution of the secondary current.

With the three-phase welder, however, the impedance of the secondary is small (as low as 40 to 50 microhms), so that the resistance of the material being welded represents a great percentage of the total resistance of the welding circuit. Any change in the resistance between the electrodes, that is in the resistance of the material, caused by thickness change or shunt path adjacent to the spot being welded, causes an almost proportionate change in the value of the secondary current.

When the second spot of adjacent welds is being welded, the lowered resistance of the secondary circuit due to the first spot automatically increases the secondary current, and there is sufficient current developed through the spot being welded to produce an acceptable weld.

What of the Future?

As the production of jet aircraft increases and as the supply of such critical materials as nickel and chromium becomes scarce or limited, there will be increased activity metallurgically toward the development of new alloys which will not require as much of the critical materials. These new alloys will need experiments to determine the most suitable welding methods, and we foresee that there will be great advances in the technique of welding and in welding machine control, which will be necessitated by the new problems arising in the welding of the new materials. Steps in the direction of wave shaping, pressure variation during the welding operation, and intermittent welding for continuous seam welding applications will be utilized to a greater extent in the future.

STEEL FOR SHOCK RESISTANCE

(Continued from page 29)

The wrap-around box supports the weight of the bed. This load is transferred to the four leaf spring plates at only four points: the midway point on each side. At these four points of attachment, the box is welded to diagonals, to which the four plates that make up the floor of this leg are also welded.

Underneath the four points of attachment there is no support to the floor. Each spring plate is supported on the ship deck at two points on a diagonal opposite to that of the reinforcement between the points of attachment to the box frame. Eight hold-down bolts in these plates are located at the four corners of the box and at the four inner corners of the plates. In effect, this arrangement creates a triangular leaf spring on each side of the diagonal between attachment points. These springs absorb deck weaving.

The vertical-channel reinforcements of the leg are above free ends of the spring plates, where any leg distortion is minimized. As these reinforcements are adjacent to bed attachments, any weaving distortion of the leg has little tendency to distort the bed. To summarize, both the head leg and the tail leg are made to absorb rather than to transmit the distorting stresses that a weaving deck may impose.

Clearly then, the design is such that a minimum of twisting stresses can be transmitted to the bed. Moreover, if any force exerted by the head leg tends to rock the bed, no resistance to rocking is imposed by the tail leg because of the gimbals mounting between this leg and the bed.

Bracket for Taper Attachment

If the welded steel lathes require a taper attachment (which, of course, overhangs the bed), it is supported by a welded steel bracket, as shown in Fig. 8. This welded bracket has ample strength and shock resistance to take high-impact loads without fracture, whereas a cast bracket might be fractured. However, the cast-iron taper guide of the former design is retained.

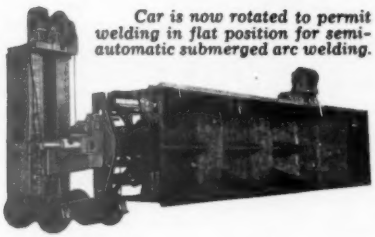
The 14-in. lathe weighs 3,838 lb without pan as against 4,145 lb for the standard heavy-duty type of lathe. However, no special effort to save weight was made. The designers are confident that considerably more weight could be saved and are certain that it could be on an equal strength or an equal rigidity basis, if this were made an objective of a future design.

Cost reduction was not a primary objective. Costs of the welded steel lathe are some 24% higher than costs on the standard cast type, but this is not surprising as new designs commonly cost more for the first few built. On the other hand, no new patterns were needed, and welding fabrication was done in an outside shop. Just what the cost balance would be if efforts to make the cast and welded designs on a competitive basis were instituted involves too much conjecture to make a valid comparison possible. What we do know is that for an application in which shock loading and weaving stresses must be considered, the welded design is much superior to the cast iron.

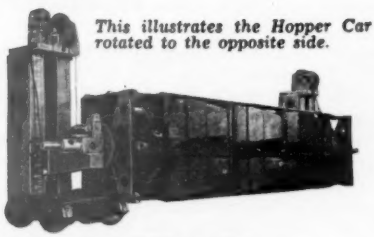
Now that lathe designers have begun to think in terms of welded structures, it will be surprising if other designs for commercial machine tools are not tried. Many other cast structures have been replaced to advantage by welded assemblies, so why not machine tools?

70-TON HOPPER POSITIONED IN ONLY 3 MINUTES

Showing Hopper Car raised from trucks.



Car is now rotated to permit welding in flat position for semi-automatic submerged arc welding.



This illustrates the Hopper Car rotated to the opposite side.

Showing how two Positioners permit simultaneous welding on two cars at one time.

It is as easy and simple to position a 70-ton Hopper Car, as it is to press a button . . . it seems highly incredible, and yet that's exactly what the Mt. Vernon Car Company (Division of Pressed Steel Car Company), and others are doing with Pandjiris WELDMORE *Heavy Duty* Positioners.

The illustrations show how this 70-ton Hopper is raised, rotated and placed in any postion through 360° . . . in only 3 minutes!

WELDMORE

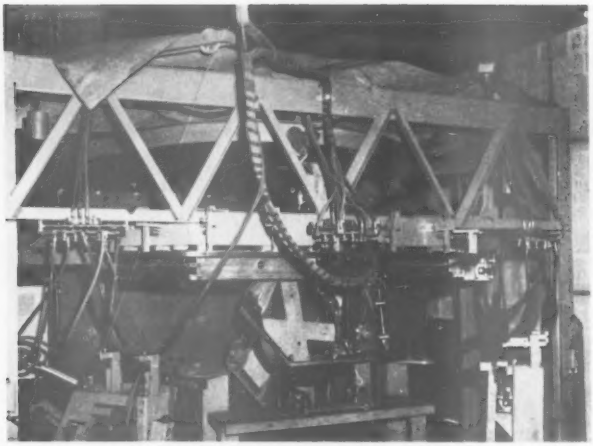
The **POSITIONER** **with Production in Mind**

Let us present facts to you, proving the practicability of employing PANDJIRIS WELDMORE Positioners for all awkward and cumbersome welding in your plant.

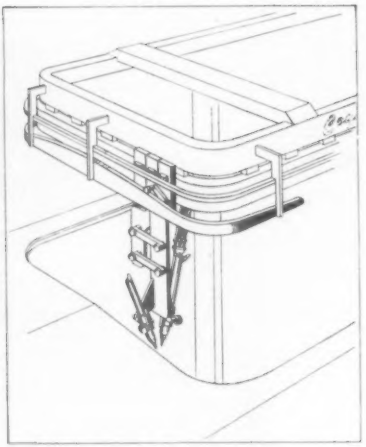
PANDJIRIS WELDMENT CO.

5151 NORTHRUP – ST. LOUIS 10, MO.

SPECIALIZED WELDING POSITIONERS ENGINEERED AND MANUFACTURED FOR ANY SPECIFIC REQUIREMENT.



FRAME of the cutting machine is attached to the hull casting by plugs and lowered until the torch parts are in proper registration



CAM raises or lowers the two torches so that they may cut at proper elevation

Armor Casting Scarfer

A new two-torch cutting machine bevels edges of armorplate castings to precision tolerances. The torch block can move horizontally, vertically or around curves.

ARMORPLATE castings for military tanks are not the easiest objects in the world to prepare for welding. Sometimes cold machining has to be used to prepare the edges because of the difficulties of flame-cutting. To simplify this tough job, a new oxy-acetylene scarfer has been developed by the Cogmatic Co., Milwaukee. It is said to be able to trim the edges on double-curved surfaces to tolerances of ± 1/64 in.

The trimming is done by two torches, positioned over the casting by means of a number of articulated sections or "trains." The torches follow machined tracks in horizontal or vertical planes or around curves. To prepare the edges for welding, a double bevel is cut, with or without an intervening land.

Track Mechanism

Torch movements are affected by a variable-speed transmission through chains following the track and connecting to the trains. The trains themselves are composed of a series of machined blocks with connecting links provided with needle bearings and plates. Needle roller bearings ride on top of and below the machined tracks to provide easy travel. A remote control allows the proper speed for a smooth, accurate cut to be maintained at all times.

One specially made machine for the front hull casting of a tank performs the operation of cutting all the scarfs on the axle opening in preparation for assembly with the bottom steel plates.

The frame of this machine was constructed by forming steel plate into a channel section, which was braced and welded. The frame is attached to the hull casting by means of plugs and lowered until the torch parts are in proper registration with the bottom opening. By bringing reference marks on the casting and frame into alignment with a jack, accurate flame-beveling is assured.

Attached to the frame are three machined tracks constructed of 1 by 6 in. steel bars. Two of the tracks are straight and parallel to each other. Each is provided with a train of blocks and with two torches. These tracks are used to cut the double bevels on the lower sides of the hull.

The third track has two sides parallel to the first two tracks and a third side at right angles to them. This track is used to cut the scarf at the front of the bottom side of the front hull casting. It has its own transmission and can be operated independently of the first two.

Operations Performed

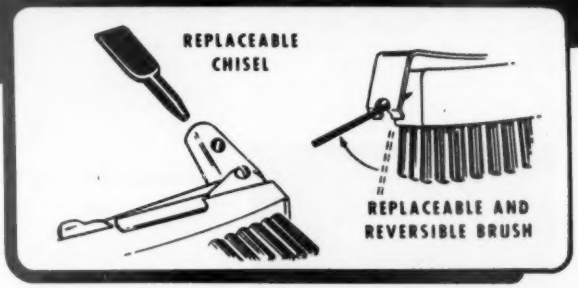
1. This machine cuts a double scarf on the bottom of the sides of the front hull casting. The planes of these scarfs are parallel to each other and 81 in. apart. These planes also have to be in the proper relation to the front bores of the tank hull.

2. The machine also prepares the front part of the bottom opening with a double scarf 7 5/64 in. long. The double scarf is 1/32 in. below the scarfs mentioned in item 1 and is in a plane parallel to them.

* * *

The sketch at the right shows details of another machine, not yet built, that will have an extra feature. In addition to the track and train of blocks of the other machines, there will be provided a special cam that will raise or lower the torches over a predetermined path so that they may cut at the proper elevation at all times.

THE MOST PRACTICAL WELD CLEANING TOOL EVER DESIGNED!



Model B-1
(With wood handle, B-1W)

Atlas "RE-BIT DUAL TOOL"

● Experience real economy with this tool that requires replacement of worn parts only! The "Re-bit" chisel can be set at any angle, has a wider edge and narrower cross section, gets into corners and pockets better, affords better vision. "Re-bit" is easier to sharpen, lasts longer . . . Ask your welding supply dealer for information on all 27 Atlas models.

Atlas WELDING ACCESSORIES CO.
707 E. LEWISTON AVENUE FERNDALE 20, (DETROIT) MICH.

New Products . . .

TAKE A SQUINT at your New Products Bulletin! A spot welder control for rusty steel, an insulated weldor's glove, more flexible Magnaflux units, a tube expanding tool

Spot Welder Control

RUST-covered, scaly or clean steel sheets can be efficiently spot welded with a single setting on a new Swiss spot welder control, according to its manufacturer. The new control automatically extends the weld time for rusty sheets until enough current has been passed to produce a good weld. The same setting can be used regardless of cleanliness or throat depth.

Three components make up the basic features of the regulator: (1) a wattmeter with instantaneous response to measure instantaneous power, (2) an integrating watt-hour meter and (3) a control that continuously compares the integrated power with the adjusted value (set by the operator according to the thickness of the sheets to be welded) and interrupts the welding current when the measured value attains the adjusted value.

The new regulator has the same dimensions as the standard Brown, Boveri timer and can be used with old or new spot welders of any manufacture. Major adjustment of the timer is the setting for sheet thickness (see above picture) after which slight adjustments of current or pressure may be necessary.

BROWN, BOVERI & CO., 19 Rector St., New York City.

* * *

Insulated Weldor's Glove

FOR outdoor cold weather welding or for inside jobs where the heat doesn't exceed 700 F, a new type of insulated glove has been developed. It is made up of three thicknesses of material, an outer layer of terry cloth (treated to make it flame-resistant), a middle layer of wool and asbestos and an inside layer (next to the skin) of soft, fleeced cotton. Long wear and extreme flexibility are additional advantages of this glove, according to the company.

SINGER GLOVE MFG. CO., 860 West Weed St., Chicago 22.

* * *

Wet Blast Chemicals

A COMPLETE line of abrasives for wet blasting machines can be obtained from stock, says American Wheelabrator, Mishawaka, Ind. Sizes supplied ranged from 80 to 2,500 mesh and are packaged in convenient 50-lb weights for easy charging of the blast machine.

Other chemicals needed for wet blasting are also carried in stock: "Anarust", a rust inhibitor that goes into solution immediately without the staining normally expected, and "Anaset", an anti-packing chemical.

AMERICAN WHEELABRATOR & EQUIPMENT CORP., Mishawaka, Ind.

* * *

Electrode Drying Oven

DIFFERENT types of low-hydrogen electrodes may be kept dry and separate in a new portable electric oven having eight drawers. The Grieve-Hendry Model TD oven weighs only 118 lb and plugs into a 110-volt outlet. Air circulation in the furnace is aided by a motor-driven fan that also forces stale air out through special exhaust ports. The drawers are heated by high-temperature magnesium-oxide strip heaters sheathed with steel.

Outside dimensions are 30 by 25 by 24 in. The drawers are each 2 in. high, 11½ in. wide and 23 in. deep.

GRIEVE-HENDRY CO., INC., 1101 North Paulina St., Chicago 22.

* * *

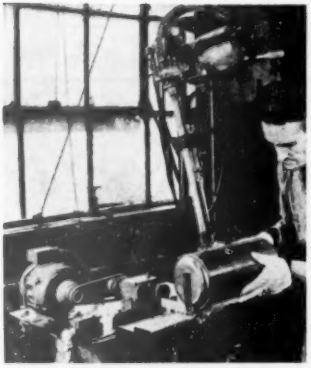
Welded Plastic Liners

COMPLETELY welded polyethylene plastic tank liners in removable and stationary designs are being manufactured by American Agile Corp. They come in all sizes and shapes with wall thicknesses up to 1 in.

Polyethylene drains and overflows can be furnished on the liners, as can plastic pipe flanges, fittings and valves permitting connections to existing pipe lines and tanks.

The chemically inert polyethylene and the welding method employed combine to make tanks that are not only leak-proof, but which can be repaired if accidentally torn or ruptured. Costs saved in maintenance and replacement of various expensive platings and shielding materials more than make up the cost of the plastic liners. The liners are made at the factory or at the job site depending on the size and complexity of design.

AMERICAN AGILE CORP., Plastics Div., P. O. Box 168, Bedford, O.



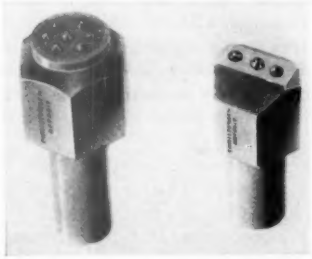
Drip Soldering Gun

CONSIDERABLE savings in labor and in solder on long production runs are claimed for the Mogul soldering gun. Lead or tin-base solders as well as silver solder are deposited in a liquid form to a part moving at constant speed under the gun nozzle. Wire solder is supplied to the gun where it passes through the center of a conical flame to be melted into a liquid or plastic state.

Speeds up to 200 lineal ft per minute have been recorded, the company states. One manufacturer makes five-gallon rectangular cans, soldering the side seam at a rate of 60 lineal feet per minute with a saving of the solder formerly required. Another manufacturer fabricates wire terminals in strip form, in which the wrap-around portion must be brazed closed. With the Mogul gun set for skip brazing the terminals are brazed at a rate of 200 per minute.

METALLIZING COMPANY OF AMERICA, 3520 West Carroll Ave., Chicago 24.

* * *



Wheel Dressing Tools

"GROUP-MOUNTED" and "Chisel-face" dressing tools for grinding wheels are two additions to the line of Christensen diamond tools. The group-mounted tool contains five, six or seven diamonds and is recommended for large OD straight-face applications. The chisel-face tools have two or three diamonds mounted in a straight line and dress large-diameter wide-face wheels.

CHRISTENSEN DIAMOND TOOL CO., 9607 Traverse St., Detroit 13.

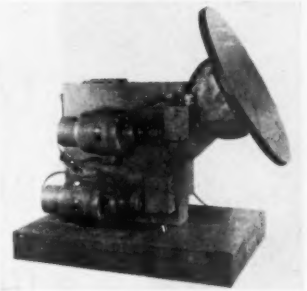
* * *

70,000 RPM Grinder

NEW air-operated grinder, the Desoutter Model O, weighs only 12¼ oz and can be operated at speeds from nearly zero to 70,000 rpm. The speed is said to be easily adjusted by a push button that locks into off and on positions. Specially built for tool and die makers, it will accept any standard grinder as well as 28 special shapes made by Desoutter.

NEWAGE INTERNATIONAL, INC., 235 East 42nd St., New York City 17.

* * *



Welding Positioner

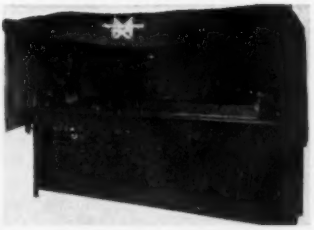
SPECIAL provisions for precisely set table rotating speeds are incorporated in the Aronson Model 21 positioner of 5,000 lb capacity. Speeds as close as 0.025 rpm can be read from a knife-edge needle on an electric generator tachometer mounted on the machine. Instant start and stop of the table is achieved through an electric clutch and brake.

Range of table rotation varies from zero to 2.7 rpm with a constant speed of 4 rpm available for quick positioning. Table tilt is accomplished at a rate of 135 degrees in 23.4 seconds.

Mercury is used as a ground conductor for both high and low current applications so that the welding ground cable need only be attached securely to the base. The controls are 110 volt a-c, with the electric clutch and brake powered by 90-volt d-c. Joint Industries Conference standards. A dust-proof master panel can be opened only if the power is off.

The entire positioner is mounted on 8-in. grooved casters that allow a track-guided movement from station to station.

ARONSON MACHINE CO., Arcade, N. Y.

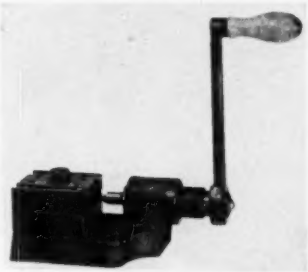


Overhaul Magnaflux Line

EXTENSIVE design engineering in the new standard line of Magnaflux units has paid off in shorter delivery times and in some cases, reduced costs. The new equipment is generally larger than the old at a comparable price; *i. e.*, from 48-in. old to 54-in. new capacity and from 72-in. old to 96-in. new capacity (see above picture). The newer units can handle a greater diversity of parts for inspection and can be operated interchangeably on either 220 or 440 volts, 60 cycle current. Maintenance, though always a minor item, has been reduced and/or simplified.

MAGNAFLUX CORP., 5900 Northwest Highway, Chicago 31.

* * *



Tube End Expander

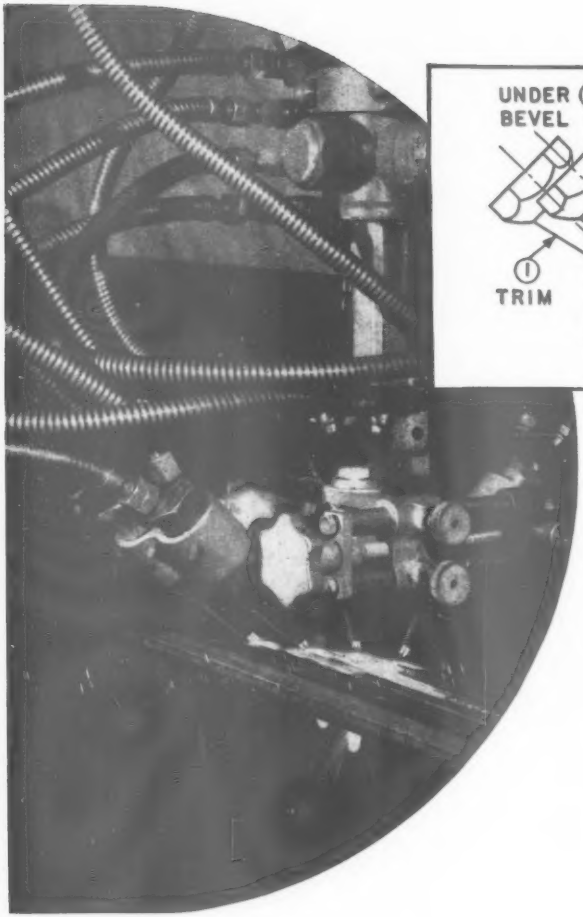
TUBE-END expander tool is claimed to eliminate the need for couplings on soft and hard copper, aluminum and steel tubes and to save one-half the soldering cost since only one joint has to be made.

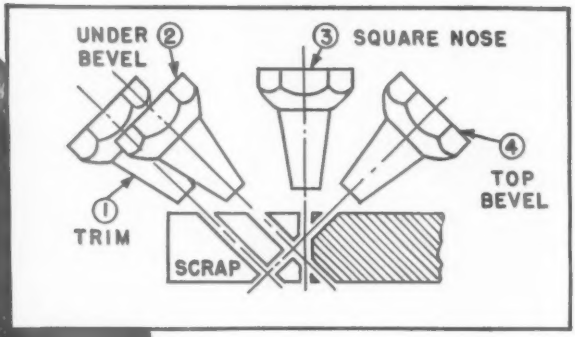
In operation, the end of a piece of tubing is simply slipped over the expanding jaws and the jig is locked down over the tubing body. A few turns of the "Handy Expando" handle and the tubing end is expanded exactly enough to slip right over a mating tube end. A tolerance of 0.002 in. is claimed.

Present models of the device weigh 10 lb and come equipped with dies necessary for the expansion of ⅜, ½, ⅝ and ¾ in. tubes one eighth of an inch.

KNUTH ENGINEERING CO., 2617 North St. Louis, Chicago 47.

(More New Products on Page 98)





One pass gets armor plate or *any* plate ready for welding

Swift-moving oxy-acetylene flames prepare steel plate edges for welding in a fraction of the time required by mechanical methods. Multiple nozzles, cutting in different planes simultaneously, slash with ease through any commercial thickness. *Just one pass to "finish" dimensions* turns out a square edge, single bevel, single bevel and nose, double bevel, double bevel and nose, or J-groove and nose. Edge preparation costs tumble; production booms.

LINDE's oxygen-cutting methods are simple and flexible. They are economical and easy to use. They cut plates so smoothly and accurately that *no machining is necessary*—edges are ready to weld "as cut". Rigid fit-up and contour specifications are easily met. Yet, initial investment in OXWELD flame-cutting equipment is only a fraction of that for comparable machine tools. Upkeep over the years is extremely low.

On-the-job power needs are negligible. Reaction of cutting oxygen with hot steel does all the work. Only fractional horsepower is required to move the cutting nozzles along a straight line, radius, or any guided path over the line of cut.

For further details, telephone or write today. LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. Offices in Other Principal Cities. In Canada: Dominion Oxygen Company, Limited, Toronto.

The terms "Linde" and "Oxweld" are registered trade-marks of Union Carbide and Carbon Corporation.

Linde
Trade-Mark

Products and Processes for MAKING, CUTTING, JOINING, TREATING, AND FORMING METALS

How to Find the Efficiency of Your Welding Business

By W. F. SCHAPHORST, M. E.

MANY welding contractors, welding job shops or welding consultants consider themselves to be exceptionally efficient because they "work every minute," as they say. But do they? Let's see about that.

This writer knows of comparatively few businesses, in welding or out of it, that are truly 100% efficient in the sense that every minute is utilized.

As an example, across the street from me are three huge buildings that cost many millions of dollars to build. The office hours are from 9 a.m. to 5 p.m., and the management appears to be proud of those short hours. No work on Saturdays, Sundays or holidays. A half hour for lunch. That means 7½ hours are utilized per day, or 37½ hours per week (if there are no holidays). But a single week has 168 hours. So these huge and expensive buildings are standing idle for 130½ hours each week. The efficiency of the buildings may be found by dividing the actual working time, 37½, by 168, the number of hours in a week. If you will perform the division, you will find that the efficiency of the three buildings from the usage standpoint is only 22.3%.

Not very efficient, you say? Then consider this example:

An arc welder has a 40% duty cycle, which means that only 40% of the time is being devoted to actual welding, the balance of the time being utilized for such jobs as set-up and alignment, removal of finished work, electrode changing, peening, scale cleaning, etc. Forty per cent of 60 minutes is 24 minutes, the amount of actual welding that is done in an hour. Let's assume that the welding operator keeps the same working hours as the employees of the buildings previously mentioned. In 7½ hours, the welder is welding 180 minutes or 3 hours. Divide 3 by 168, and you will find that the machine has an efficiency of 1.79%.

Not very efficient, is it?

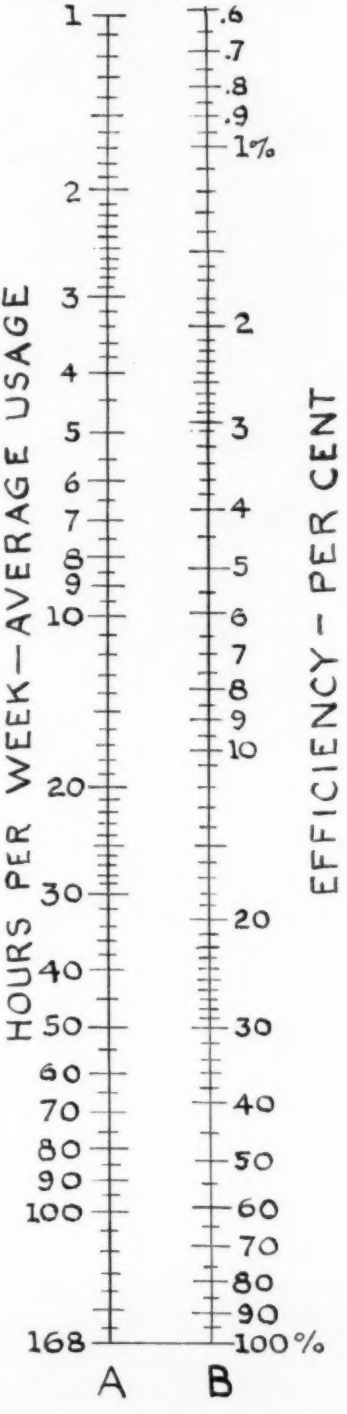
Now what is the efficiency of your welding organization? Your buildings, if you have any? Your workers? Your welding machines? You yourself? The chart at the right will give you the answers in a jiffy if you only know the number of hours of usage of equipment, manpower or building per week.

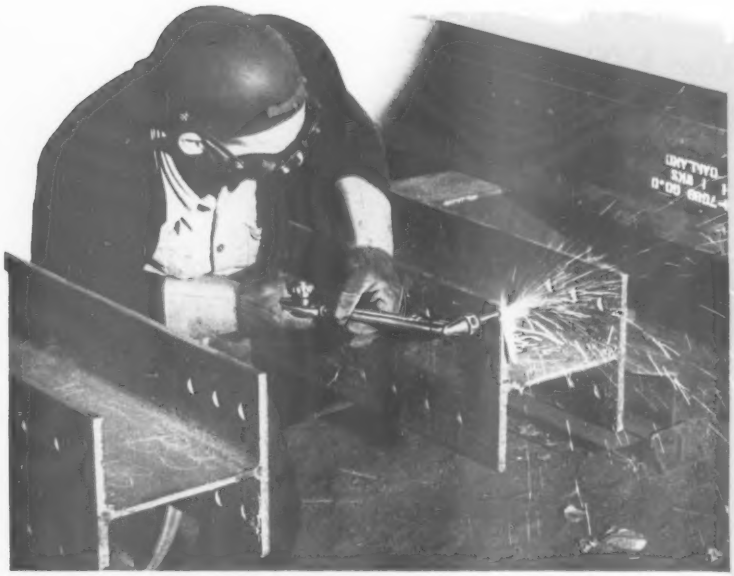
Find the average usage in hours per week in column A. Then read straight across to the corresponding scale division in column B. That will give you the required percentage of efficiency.

As a practical example, if you have a 40-hour work week and your equipment is working every minute of that time, the efficiency is 24%, as given in column B. From 40 read straight across to 24, noting that both scales increase as you go downwards.

Full 100% efficiency is, of course, an impossibility. Even if you are working around the clock with three shifts a day and seven days a week, machines have to have some down-time for maintenance and repairs. Nevertheless, it is interesting to make a few comparisons. The average home is much more efficient from the standpoint of utilization than the average business property, believe it or not. The average church, the writer estimates, has an efficiency of less than 10%, which point could be advantageously used by ambitious ministers of the gospel. It is said that the devil never rests so why should church property rest?

This matter of efficiency is well worth bearing in mind before you make that next important purchase. Can you get along without a new machine, a new building, a new office or a new what-not by making your present one more efficient? Maybe you can—this chart will help you in figuring it out.





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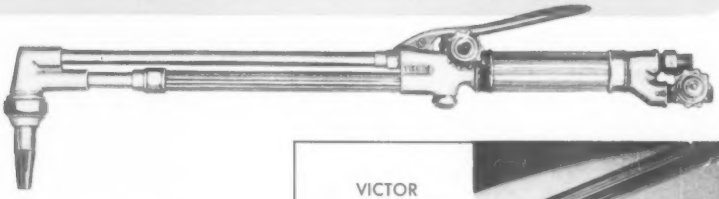

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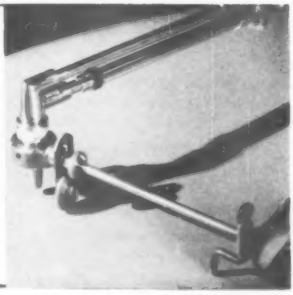

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2 INDUSTRIAL SANDER — Millers Falls Co., Greenfield, Mass. Literature tells about the No. 870 industrial sander for doing fast sanding, wire brushing, grinding and polishing on metal, wood, tile, plastic, glass and concrete. See page 98.

3 ELECTRODE DRYING OVEN — Singer Glove Mfg. Co., Chicago 22. Description and specifications for the Model TD portable electric oven show how it is valuable as an oven for keeping low-hydrogen electrode coatings at the proper moisture content. See page 46.

4 LIQUID SOLDERING GUN—Metallizing Co. of America, Chicago 24. Literature explains production economies possible with the Mogul soldering gun that can deposit liquid solder on long seams or on properly aligned short seams with low cost and high speed. See page 47.

5 PERMALATEM ALLOYS—Permalatem Welding Alloys, Inc., Neptune, N. J. 78-page pocket-size catalog on acetylene and arc welding alloys for every application gives description of each type and welding instructions for best results. Index at end of book is a handy guide to various rods.

6 INDUSTRIAL X-RAY — Picker X-Ray Corp., White Plains, N. Y. 14-page, pocket size folder gives a concise review of Picker X-ray equipment for fluoroscopic inspection, radiographs, processing radiographs and viewing radiographs. Machines shown range from small 5 to 50 kv units up to 22,000,000 volt betatrons for checking cast armor and ship steel.

7 NEW MAGNAFLUX UNIT—Magnaflux Corp., Chicago 31. Illustration sheets compare the increased length and versatility of redesigned Magnaflux equipment with former models, including maintenance features and power supply. See page 47.

8 INSULATED WELDING GLOVE—Singer Glove Mfg. Co., Chicago 22. Bulletin tells about unique triple-thickness construction of new welder's gloves that will withstand 700 F heat or very coldest weather on outside welding jobs. See page 46.

9 WELDING DIRECTORY—Eutectic Welding Alloys Corp., Flushing, N. Y. 16-page profusely illustrated booklet gives technical data and application ideas on Eutectic Low Temperature Welding Alloys for use on steels, copper, brass, aluminum, magnesium and hardfacing materials.

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10 SPOT WELD REGULATOR—Brown Boveri & Co., New York City. Literature tells about a new type of "electronic energy regulator" that automatically compensates for rusty, scaly or dirty metal to make good welds. Only control that has to be set is one for the combined thickness of sheets to be welded. See page 46.

11 70,000 RPM GRINDER — Newage International, Inc. 235 East 42nd St., New York City 17. Catalog tells about the Model 0 grinder for tool and die makers that works at speeds from near zero to 70,000 rpm. Operating characteristics, construction and equipment for the Model 0 are described. See page 47.

12 AIR-GAS TORCHES—Insto-Gas Corp., Detroit 7. 4-page bulletin gives pictures and explanations of 15 types of torches, furnaces, assemblies, heaters, cylinders and other equipment for use with "Insto-Gas." Soldering iron torches, pencil flame torches and annealing torches are among the types shown. Characteristics of the gas are also explained.

13 FURNACE MAINTENANCE — The Hevi Duty Electric Co., Milwaukee 1. 16-page maintenance guide for electric heat treating furnaces discusses cleaning of heating elements, care of fans and blowers, brickwork and insulation, alloy retorts and fixtures and thermocouples. Cartoons illustrate important points.

14 TUBE EXPANDER — The Knuth Engineering Co., Chicago 47. Tight joints in light tubing can be made with the aid of a tube expander that enlarges the end of thin-walled tubing just enough to fit snugly over a mating tube end. Description includes possible applications in the food and chemical fields. Page 47.

15 FURNACE BRAZING — Lindberg Engineering Co., Chicago 12. Tips on furnace brazing of food machinery components with silver solder are illustrated with several photos of typical parts and equipment used in Vol. VIII, No. 1 of Lindberg's *Heat Treating Hints.*

16 WELDING POSITIONER—Aronson Machine Co., Arcade, N. Y. Literature gives turning and lifting speeds of new precision welding positioner for making aircraft, tank or auto components. Electrical and mechanical features are explained with regard to how they improve welding efficiency. See page 47.

17 WELDING ELECTRODE — Philips Electrical Ltd., Industrial Group, London, W. C. 2., England. 28-page brochure PD-3172 is a comprehensive review of all welding and application characteristics of the Philips "48" welding electrode. Coating, mechanical and chemical properties, speeds, etc. are covered in the text and 18 tables.

18 WATER TREATING COMPOUND —Haas Miller Corp., Philadelphia 40. 10-page pocket size booklet tells about "Immunol" compound for "rustproofing" water as well as making it a powerful solvent and wetting agent. Descriptions outline its possibilities as a quencher in spot welding, as a rustproofer and as a cleaner of fluxes or greases.

19 BRAZING CATALOG — All-State Welding Alloys Co., Inc., White Plains, N. Y. 6-page folder gives instructions for brazing, welding and cutting steel with 12 different alloys put out by All-State. Properties of the alloys and operating hints are clearly presented.

20 GAS BRAZING—Industrial Heating Dept., Westinghouse Electric Corp., Meadville, Pa. Bulletin DB-28-825 provides 8 pages of complete information about the packaged "Monogas" generator. Eight typical applications shown are annealing, brazing, normalizing, drawing and gas carburizing.

21 PYROMETRY—Tempil Corp., New York City 11. 4-page reprint titled "Notes on Pyrometry" by G. M. Welten, PhD., tells about the various types of instruments for the determination and control of industrial working temperatures.

22 ELECTRICAL TROUBLESHOOTING — Pyramid Instrument Corp., New York City 13. 16-page bulletin No. 504 tells about using the "Amprobe" voltammeter for finding trouble spots in electrical systems, for saving time in servicing and for other maintenance and repair uses.

23 WET ABRASIVE BLASTING — American Wheelabrator and Equipment Corp., Mishawaka, Ind. Bulletin 23 tells about the Model 43 "Liquamatte" for wet abrasive cleaning where close tolerances must be kept or where breakdown of sharp edges or corners must be avoided. Photos and engineering drawings show all principles and the text discusses possible applications.

24 STUD WELDING—KSM Products, Inc., Merchantville, N. J. 28-page booklet tells all the do's and don'ts for operating stud welding guns and is a good review of the entire gun assembly in such equipment. A photo guide shows how to properly stud weld.

25 AMPCO METALS — Ampco Metal, Inc., Milwaukee 46. 4-page bulletin G-1 gives cost-saving information on the uses of Ampco metal and Ampcoloy alloys in bearings, gears, cams, dies, wear strips, etc. Corrosion-resistant properties and other information are also included.

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HOW TO HELP BRITAIN ...and Ourselves

The purpose of this editorial is to help Winston Churchill obtain the aid Britain needs

(1) to weather her present financial crisis, and

(2) to avoid a chronic recurrence of such crises.

This is not a philanthropic purpose.

Britain is our staunchest ally in the free world's continuing fight for survival. She cannot perform her role effectively if she is broke, or if she careens from one financial crisis to another.

Then, too, a nation such as ours—committed to private enterprise as a way of economic life—has a special interest in helping Winston Churchill to help Britain. His administration is relatively friendly toward private enterprise. Should he fail, he would be replaced promptly by a Socialist government more hostile than ever. And that would weaken the standing of private enterprise in the free world.

Cause of the Crisis

It is the drive of the Western World under our leadership to rearm against Russian aggression that has precipitated Britain's financial crisis. It set off a scramble for raw materials from which armaments could be made, and for many other materials that might be short in the event of war. So the prices of the things that Britain must import—mostly raw materials—have been boosted more than the prices of things she can export—mostly finished products. That leaves Britain short of funds to pay for essential imports. This difficulty increases as the necessity becomes more urgent to divert industrial effort from production for export to production for security.

The Basic Trouble

Although Britain's immediate crisis was touched off by the rearmament drive of the Western World, her basic affliction is one from which she has suffered since the end of World War II. Stated in its simplest terms, Britain does not produce enough goods to pay her own way as one of the family of free nations.

For years this deficiency in home production was made up by income from shipping and overseas investment. But Britain had to sell a large part of her foreign investments to finance her heroic part in World War II. So her income from that source has been greatly reduced. And, in spite of an increase of about a third above prewar in her own production of goods and—thanks to a continued "austerity" program—a much larger increase in her exports, Britain still is not paying her own way.

Two Ways to Solvency

Britain has two ways to restore her solvency. One is to cut down on what is consumed—the belt-tightening process. The other is to step up British production.

To surmount the present crisis, Mr. Churchill has asked for some cutting down. He probably must ask for more.

Except as a stop-gap expedient, however, more cutting down of Britain's consumption is clearly a dangerous course. That would further depress a British standard of living which, not more than half as high as ours, already is too low. Politically such a course would grease the skids for Winston Churchill's administration, even now governing by a wafer-thin parliamentary margin. Also, as *The* (London) *Economist* remarks, the "lazy expedient of cutting trade" would result in "hurting other people and forcing them to take similar action"—by cutting the market for their products.

The Only Cure

The best and, in fact, the only way to help cure Britain's economic ills is to help Britain produce more. Here the technical possibilities are encouraging. On the average, the British industrial worker produces only about 40 percent as much a year as the American worker. That is a British estimate, made by Sir Ewart Smith.

Wider use of better industrial methods and modern tools and an infusion of the competitive incentive into British industry — to replace the cartel and other restrictive practices — would go a long way to narrow this wide gap in worker productivity. This is the consensus of experts on both sides of the Atlantic.

Since 1948 the Anglo-American Council on Productivity has done much to encourage output per man-hour in Britain and to foster this doctrine with both labor and management. But much yet remains to be done.

In the United States it is increasingly suggested that before we give Britain any more economic aid we should insist that everything possible be done to exploit the technical possibilities of increased production. This emphasis on production is needed. But if we Americans were to impose upon the hard-pressed British people conditions that could be construed as an affront to a friendly and sovereign nation, we might well put into the hands of a masterful rabble-rouser such as Aneurin Bevan, the anti-American leader of the Labor Party's left wing, a campaign issue on which to maneuver himself into the Prime Ministership.

Churchill Can Insist

But Winston Churchill is not so handicapped as we should be in imposing prerequisites of further aid. As Britain's own, most honored leader he will raise no touchy questions as to Anglo-American relations if he insists that Britain have firm plans to cure her economic ills, plans sharply focussed on ways and means of increasing Britain's industrial efficiency.

By presenting a convincing plan to cure Britain's recurring crises through greater production, Mr. Churchill will greatly facilitate the process of getting the aid his country must have. He will also remove an increasingly dangerous element of dissension in Anglo-American relations—the feeling of many Americans that more aid to Britain is more money down the drain. The way to counter that feeling is to come up with a prescription for an economic cure, not a request for another economic poultice.

Technically, such a program is entirely feasible. It will perhaps be the supreme test of Winston Churchill's statesmanship to make it politically feasible as well.

In the interest of Britain, of the United States and of the whole free world, we wish him all success.

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Courtesy Linde Air Products Co.

FLAME-HARDENING of tractor idlers is done by using six heating heads attached to oxyacetylene torches

Courtesy General Electric Co.

ROOMIER, stronger and more weather-resistant cabinets for traffic signal control are made by welding

Hardening Tractor Idlers

(See left picture)

TRACTOR idlers are given a hard, wear-resisting surface with oxyacetylene flames at the Harrison Steel Castings Co., Attica, Ind. The idlers are made of cast steel having 0.42-0.48% carbon and 0.65-0.85% manganese. The flame-hardening treatment increases the surface hardness from around 200 to approximately 500 Brinell. The hardness extends only ⅛ in., leaving the tough, shock-resistant core of the idler unaffected.

The above picture shows the setup. Three idlers are flame-hardened at a time by using six heating heads (two for each idler). The idlers are hardened within a few minutes. There is no change in the chemical analysis of the finished product and no sharp demarcation between the hardened zone and the softer core.

* * *

Signal Boxes Welded

(See right picture)

BY SWITCHING from a bolted assembly to welding, the Eagle Signal Corp., Moline, Ill., was able to cut production costs 20% on the aluminum cabinets housing its traffic signal controller. Moreover, the cabinets are now weatherproof.

The problem of protecting the delicate controls from bad weather conditions had long been a headache to the company's engineers. Previous to welded assembly, the boxes were held together with long tierod bolts, and sponge rubber strips were then glued along the edges of the joints. However, the cabinets could be jarred out of alignment, allowing rain and dust to seep through the cracks.

Eagle Signal Corp. now uses an inert-arc welder to join the cabinets by manual welding. The accompanying picture shows the special jig developed to do this job on a production basis.

Welding is also used to attach the brackets supporting the controls inside the cabinet. This provides even more complete weatherproofing as it does away with bolt holes.

Other advantages of the new assembly method: No more expensive tierod bolts and sponge rubber. More room inside for installation of the traffic controls. No nuts and bolts for the supporting brackets. No drilling of bolt holes. A saving of time and material that was impossible under the old system.

* * *

Safer, Less Annoying

TO SHIELD off a welding operation that constituted a safety hazard and a source of annoying glare for nearby workers, a weldor at the Torrance, Calif., plant of The National Supply Co. constructed a steel box around the job location. The company, manufacturer of oil-field machinery and equipment, is turning out gun tubes as part of its ordnance work. Before a gun tube is heat treated, a bail or half-ring is welded to one end to lift the big tube and suspend it in the vertical furnace.

* * *

Besides Bronze Is Scarce

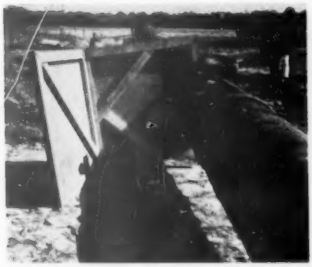
A. THORDSEN Ornamental Iron Works, Davenport, Ia., manufactures attractive hand rails for cement porch steps. The rail spirals about a newel post, a vertical upright set in the concrete at the bottom of the steps. To make sure that rust wouldn't spoil his careful workmanship, Mr. Thordsen used to coat with bronze the sharp-pointed end of the newel post that was to be embedded in the concrete.

Here's what it was costing him:

Bronze, 4.9 oz. @ $1.39 lb.	$0.426
Labor, 12 minutes @ $2 per hour	0.40
Flux	0.035
Gases	0.12
Overhead @ 25%	0.242
Total	$1.223

He now uses a "touch-up" pencil that provides a protective coating. The newel-post point is tinned immediately after it has been hot forged. Time needed to apply the coating has been cut from 12 minutes to 20 seconds. And the total cost, including everything, is 7c per piece. The net saving, therefore, is $1.153 per rail.

The tinned surface, according to the All-State Welding Alloys Co., Inc., White Plains, N. Y., is able to withstand such severe corrosion as 400 hours of exposure to salt spray.



WIND-BORNE dirt is kept out of pipe welds by this simple screen

Screen for Pipe Welding

By Elton Sterrett

ON MANY pipe-line jobs, wind and wind-borne sand slow down and annoy the weldor. Sometimes dirt is blown into the unfinished weld, causing defects that seriously lower the quality.

To keep out the wind, one contractor equips his men with lightweight shields of ¼-in. plywood. Each shield has frames built of 2 by 4 in. scrap lumber to make two 4 by 4 ft sections. The two sections are hinged together so as to allow the dual unit to be set up to brace itself.

One of the two sides is cut out to fit closely to the outside diameter of the pipe when coated and wrapped. This semicircular aperture is placed against the pipe. The screen is thus suspended on the pipe at one end and supported on the ground at the other.

A weight—preferably a small bag of sand—is used to prevent the screen from being dislodged by a sudden gust of wind. The weight is hung from a screw-eye inserted in the short piece of framing that is just above the pipe notch. The weight, when dropped across the pipe on the side away from the weldor, pulls the notch into close contact with the pipe. Should it be necessary to rotate the pipe, the shield and its weight allow the pipe to be turned for welding without dislodging the shield.

* * *

Coating for Stainless

SOLAR Aircraft Co., San Diego, Calif., which recently announced development of a coating process that enables stainless steel to resist oxidation under high temperatures, reports it has licensed Ferro Corp., of Cleveland, to manufacture and market the product on an exclusive basis. Thus far the process has been confined to use in jet aircraft exhaust systems.

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SWAN DIVE off a mountainside banged this grader up considerably, but the welded frame was still in alignment afterward. It bounced more than 30 ft when it hit

NIGHT OUT with the wife at Kansas City fall AWS meeting goes over big. It also convinces the wife hubby will be in good company the rest of the year's AWS nights

NEWS

Detroit Welding Conference Set for April 16-18

FOR the third year, Detroit area welding men are privileged to attend a special Detroit Welding Conference from April 16 through 18. Sponsored by the Detroit section of the American Welding Society, the American Institute of Electrical Engineers and the Industrial Electrical Engineers Society of Detroit, the program will include technical papers, exhibits and a plant trip. Site for the meeting will be Detroit's beautiful Rackham Memorial Building.

C. M. Clark of the Duquesne Light Co. is the chairman for the conference. His executive committee consists of the following men: papers, E. J. Limpel, A. O. Smith Corp.; publication, C. M. Rhoades, Jr., General Electric Co.; publicity, J. S. Francis, Consumers Power Co., Jackson, Mich. and Stanley H. Brams, McGraw-Hill Publishing Co., Detroit; demonstrations, Dr. A. DiGiulio, consultant, Detroit; local chairman, S. W. Luther, Detroit Edison Co.; secretary, J. F. Deffenbaugh, Federal Machine & Welder Co.; AWS representative, Keith Sheren, Swift Electric Welding Machine Co. and Industrial Electrical Engineering Society representative, V. H. Chisholm, Hudson Motor Car Co.

Old Lincoln Electric Plant to Make Jet Parts

NEGOTIATIONS were recently completed at Cleveland whereby the old Lincoln Electric Company plant at Eddy and Coit Roads will be leased to Thompson Products, Inc., for the manufacture of jet engine parts. Purchaser in the transaction was the Eddy-Coit Company of Cleveland, a subsidiary of Sixty Trust of Boston, employee's pension trust created by Textron, Inc.

Estimated price of the big seven-building plant was about $3,000,000. It is understood that Thompson will take the factory for a five year period. Thompson will take over the entire plant with the exception of 180,000 sq ft, which will be retained by Lincoln Electric until March 15.

* * *

Scrap Shortage Closes Gary Steel Furnaces

FOR the first time since World War II several open-hearth furnaces at the U. S. Steel plant in Gary, Ind., were shut down because of scrap shortages. The shutdown occurred early in January. According to NPA, the shortage will probably restrict steelmaking in Pennsylvania, New York and Ohio as well.

Grader Falls 2,500 Ft, Welded Frame Holds

FLYING leaps down 2,500 ft of mountainside aren't recommended for Caterpillar graders, but one did just that recently and is back in service again. The welded frame was undamaged.

It happened on the John Delphia Ranch in California. A new No. 12 Diesel motor grader, with only 99 hours on it, somehow got away from its operator and went over the side of a mountain. Its estimated speed some 2,500 ft down from the start was 80 mph.

Landing on its nose, the grader bounced 30 ft in the air, tearing the motor off the chassis. The radiator was torn away from the motor and the oil pan was demolished, but the motor kept running wide open. It continued to run, without oil or water, until a bystander managed to reach the scene and shut it down. According to witnesses, the motor did not stick or freeze and could be turned very freely by hand pressure on the flywheel.

The front wheels were broken completely away from the welded frame, but the carriage was not damaged or sprung. The frame appeared to be in perfect condition when it was brought into the ranch.

* * *

Western Welding Suppliers Meet at San Francisco, Feb. 7-8

DISTRIBUTORS and manufacturers of welding equipment will get together at the western zone meeting of the National Welding Supply Association, scheduled for Feb. 7 and 8 at the St. Francis Hotel in San Francisco.

Read the facts about

AIRCO's NEW NO. 20 RADIAGRAPH

Up-to-the-minute in design, the No. 20 Radiagraph is Airco's newest service-proven portable gas cutting machine.

. . . So you'll know about the first gas-cutting machine designed to carry Aircomatic®, Heliwelding, Flame Hardening, and other *fabrication* equipment . . .

. . . So you'll be among the first to know how the No. 20 Radiagraph cuts circles and arcs, any length straight lines, simultaneous parallel lines — with single or double bevels, and irregular shapes.

. . . So you'll know how this 57-lb. one-man portable can be put to work for you, we've written up all the detailed information you need in a quick-reading, 8-page folder. To get your copy of the No. 20 Radiagraph catalog, please fill in the attached coupon and mail it to us today, or write us on your business letterhead.

AIRCO®

AIR REDUCTION

AIR REDUCTION SALES COMPANY • AIR REDUCTION MAGNOLIA COMPANY
AIR REDUCTION PACIFIC COMPANY
REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
Divisions of Air Reduction Company, Incorporated
Dealers and Offices in Principal Cities

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AH AIR REDUCTION PRODUCT

Air Reduction Sales Company
A Division of Air Reduction Company, Inc.
Advertising Department
60 East 42nd Street
New York 17, N. Y.

Gentlemen:

Send me the No. 20 Radiograph catalog today.

Name _____ **Title** _____
Company _____
Address _____
City _____ **Zone** _____ **State** _____

Sylvania Tungsten Electrodes being ground in centerless grinder. Such expert handling and quality control pay off in the premium performance of all Sylvania Electrodes.

WELDING ENGINEERS!
SYLVANIA TUNGSTEN ELECTRODES GIVE YOU BETTER PERFORMANCE!

For sound, successful welds of extra-high strength, try Sylvania Pure Tungsten Electrodes. Quality controlled from ore to finished product in Sylvania's own clean plants . . . checked at more than 50 points to guarantee you dependable arc control and uniform welding results.

Also try Sylvania Thoriated Tungsten Electrodes. They give dependable starting at lower circuit voltages and less contamination in touch starting. All electrodes available in every common size and finish.

Order now for immediate delivery, without allocation, from leading welding distributors

SYLVANIA

Sylvania Electric Products Inc., Tungsten and Chemical Div., Towanda, Pennsylvania

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES, LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

Mail this coupon NOW!

Sylvania Electric Products Inc.
Dept. T-1102, Towanda, Pa.

Please send me complete information about the full line of Sylvania Tungsten Electrodes.

Name_____

Company_____

Street_____

City_____ Zone____ State_____

California Shop Specializes in Automatic Hard-Facing

CAREFUL planning and long experimentation are the only secrets the Automatic Welders & Rebuilders, Inc., Portland, Ore., claims for its current success. Steady growth and customers who come back for repeat performances are another mark of the firm's acceptance by industrial logging and construction firms in the Northwest.

According to *Fusion Facts*, a publication of Stoody Co., owners Hal Everitt and Cliff Peterson carefully checked the potential for work in the area before they settled down in one corner of a large building just outside of Portland. Since automatic rebuilding was new in 1949 to most people, the owners also realized they were in for prolonged experimentation and development on some jobs. Today the shop occupies the entire building but considerable time is still devoted to testing new applications.

Size of the jobs done at Automatic ranges from cylindrical pieces as small as 4-in. in diameter to more than 11 ft in diameter. Automatically rebuilt parts have varied in weight from 2 lb to 7½ tons.

Though the 13-man crew at the shop has done wonders with hard-facing, they avoid extravagant claims on savings. They tell customers a rebuilt part will afford savings of 40 to 50% under new replacements.

Worn parts come into the shop largely through the efforts of the company's trucking service. The latter extends into parts of Washington, California and the whole state of Oregon. Equipment commonly being rebuilt includes tractor rolls, idlers, crane wheels, clutch and brake drums, all types of crushers, house rolls and rings and cylindrical cast iron parts.

* * *

New Welding Sales Firm at Houston, Tex.

VAN Dreser & Hawkins, welding equipment manufacturers' representatives, opened for business in December at 7751 El Rancho, Houston, Tex. Principals in the firm are M. J. Van Dreser, one time sales manager for McKay Co. and R. L. Hawkins, formerly with Harnischfeger Corp.

The company operates in the four-state area of Arkansas, Louisiana, Oklahoma and Texas for manufacturers whose products are sold through welding distributors. They contact about 200 distributors in the southwestern part of the country.

There's No Other Welding Tee Like This!

FLOWLINE
TRADE MARK

STAINLESS STEEL, MONEL, NICKEL and INCONEL WELDING FITTINGS

Preferred for Dependable Corrosion Service

Features of FLOWLINE Tees

- Cold formed – seamless – by the exclusive Welding Fittings process.
- Reinforced crotch – tee is stronger than pipe with which it is used.
- Full center to face dimensions.
- Smooth interior walls.
- Ends machine tool cut and finished.
- Annealed, cleaned bright, passivated.
- Heat number permanently stamped on each tee as record of actual analysis and physical properties.
- Every tee is marked with type of metal, size, schedule, wall thickness, and FLOWLINE trade mark.

WELDING FITTINGS CORP.

NEW CASTLE, PENNSYLVANIA

World's Largest Manufacturer of Stainless Welding Fittings

NO MATTER HOW YOU HEAT...

The method of heating for low temperature brazing is a decided factor in the selection of the right silver solder and flux. Specify GB and you're right, because you'll get a combination that was made to work right!

OXY-ACETYLENE
INDUCTION
AIR-GAS
SALT BATH
BUNSEN BURNER
OXY-HYDROGEN
OXY-PROPANE
OXY-CITY GAS
CARBON TONGS
RESISTANCE
FURNACE BRAZING
CHARCOAL
BLOW PIPE

GB's line of six standard silver solders offers a range which meets standard production methods. When special solders are required, GB's Technical Service Division offers assistance which is based on experience in alloying and refining precious metals that goes back more than 80 years.

GB Standard Silver Solders

GB No. 50	Silver Solder, melting range	1160-1175°F
GB No. 50N	Silver Solder, melting range	1240-1260°F
GB No. 45	Silver Solder, melting range	1125-1145°F
GB No. 41	Silver Solder, melting range	1125-1160°F
GB No. 35	Silver Solder, melting range	1130-1270°F
GB No. 31	Silver Solder, melting range	1130-1300°F

GB FLUXES

The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder — they were developed to produce maximum results when used together.

GB DATA BOOK

Here's real factual data on all of the important phases of low temperature brazing. You can get a free copy from your GB Distributor — Write us and a copy will be forwarded to you.

GOLDSMITH BROS. SMELTING AND REFINING CO.
1304 W. 59th Street, Chicago 36, Illinois
Suppliers of Precious Metals to Industry Since 1867

American Welding Adds New Machine Division

NEWEST addition to the production facilities of The American Welding & Manufacturing Co., Warren, O., is the Warren Machine & Die Division. The latter was formerly The Warren Machine & Die Co. until its recent merging with American Welding.

John W. Slavik, who established Warren Machine in late 1946, has accepted the newly created position of manager of machined products development for American Welding, reporting to E. C. Fales, executive vice-president.

The transaction provides American Welding with an additional 4½ acres of useful industrial property, including a modern single-story plant of 5,400 sq ft area with over 300-ft frontage on a main road.

Another addition to plant and equipment of American Welding announced this fall is now well under way next to the main plant. Part of these facilities will go into production an American Welding's extensive orders for jet and reciprocating aircraft engine parts.

* * *

New M&T District Managers at Newark, Pittsburgh

ROBERT T. Brown, formerly district manager for Metal & Thermit Corp. in Newark, has taken over the Pittsburgh office. He replaces Orville T. Barnett who resigned to join Ace Equipment Co., Chicago. Mr. Brown started with M&T in the production department and later transferred to sales, where for several years he headed technical service on both electrodes and Thermit.

Nicholas F. Kiernan has assumed the district managership at Newark. He has been with the company since 1938 when he joined as a test weldor. In 1942 he was transferred to the research laboratory, in 1945 joined the New York district sales organization. Since the Newark office was set up in 1948, he has been one of the top ranking salesmen of the electrode division.

* * *

Electric Steel Furnaces Produce 7,500,000 Tons

THE average increase in capacity since 1945 of American electric steel furnaces has been 45%, to an annual capacity of 29,573 tons each. Electric furnaces in the industry numbered 256 in 1951, according to the American Iron and Steel Institute, with a total annual capacity of 7,570,813 tons.

Tempilstik°

the amazing Crayons that tell temperatures

A simple method of controlling working temperatures in:

- WELDING
- FLAME-CUTTING
- TEMPERING
- FORGING
- CASTING
- MOLDING
- DRAWING
- STRAIGHTENING
- HEAT-TREATING IN GENERAL

It's this simple: Select the Tempilstik° for the working temperature you want. Mark your workpiece with it. When the Tempilstik° mark melts, the specified temperature has been reached.

$2 gives up to 2000 readings

Available in these temperatures (°F)

113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
225	363	800	1350	1900
238	375	850	1400	1950
250	388	900	1450	2000

Also available in pellet or liquid form

FREE —Tempil° "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

Tempil° corp.
134 WEST 22nd STREET
New York 11, N. Y.

Copper Brazed on Steel May Help Shortage

A NEW method for producing copper clad steel may be a timely answer to the critical copper shortage nowadays. Demonstrated in the metallurgical laboratory of the Jas. H. Herron Co., Cleveland, the process is the result of ten years of research.

W. L. Ulmer of the Automatic Gasflux Co. worked with Superior Flux & Mfg. Co., Cleveland, to produce sheets that are 80% steel and 20% copper. They are a combination of corrosion resistance and strength heretofore separately associated with copper and steel.

Deep drawing and other deformations can be performed on the sheets without separation of the copper and steel. Any percentage of copper or brass to steel can be produced from 10% up.

Basically, the process consists of casting copper alloy on thick slabs of steel. A special flux, in highly volatile liquid form, is used to make the bond between the copper and steel. Prior to the development of this flux by Mr. Ulmer some 12 years ago, the process had been known but had not given satisfactory and uniform performances. Other liquid and solid fluxes were not completely disposed of by the heat so the residue formed pockets and inclusions in the joint.

Mr. Ulmer explains that his method of cladding is only an extension on a large scale of the brazing processes successfully performed on smaller pieces for many years. Experimental work on the cladding of copper to other metals, such as stainless steel, has also been done.

So-called "bi-metal" slabs up to 3½-in. thick, carrying about 20% copper and 80% steel, have been made and successfully hot rolled into sheet, bar and commercially sized sheet and strip. Sheets down to 16-gage thickness and 30-in. wide were hot-rolled and this was then cold-rolled down to 0.005-in.

Negotiations are said to be under way with one of the country's large steel mills for the production of substantial tonnage of copper clad sheet made by the Ulmer process.

* * *

Babcock & Wilcox Tube Co. Changes Status

THE Babcock & Wilcox Tube Co., a wholly owned subsidiary of The Babcock & Wilcox Co., was dissolved Dec. 31. The tube company's business and assets will be absorbed by and it will be operated as one of the divisions of The Babcock & Wilcox Co.

$1718 Saved

. . . by "Bronze-Facing" large gear with wear-resistant Ampco-Trode* 300

HERE'S a large 10'6" diameter tube-mill gear with 120 teeth and an 11-inch face. A new one costs $2,148. This one was made better than new by "Bronze-Facing" it with wear-resistant Ampco-Trode 300 for only $530. Time required for the entire job — 82 hours.

You, too, can enjoy the savings in time and money made possible by "Bronze-Facing" with Ampco-Trode. Other advantages are: longer life and less down time. For instance, after 5 months' service in a cement mill, this gear showed little or no wear — thanks to the 300 Brinell tooth-surface hardness provided by Ampco-Trode 300.

In these days of shortages and long deliveries you'll find Ampco-Trode bronze electrodes a big help. Get a supply today from your Ampco distributor or write us.

W-113

AMPCO **Ampco Metal, Inc.**
Milwaukee 46, Wisconsin

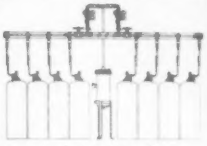
It's Production-Wise to Ampco-ize

*Reg. U. S. Pat. Off., Ampco Metal, Inc.

MANIFOLDS

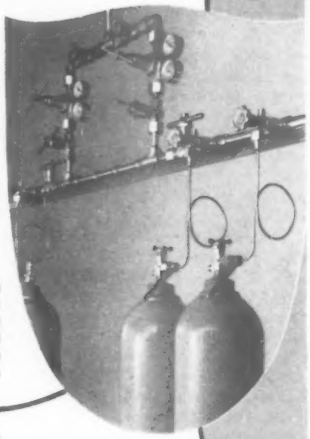
REGO

Typical Single Regulator Wall-Type Oxygen Manifold



Typical Dual Regulator Floor-Type Acetylene Manifold

for OXYGEN ACETYLENE HYDROGEN NITROGEN and other high pressure gases



Rugged construction and precision control equipment give RegO manifolds long life, safe performance and low maintenance.

Continuous Operation . . . Shut-off valve at each cylinder station permits removal of any cylinder without shutting down entire side of manifold. Master valves control each bank of cylinders.

Unit Construction . . . Header consists of steel I-beam, extra heavy brass pipe and fittings, cylinder station and master shut-off valves . . . with all permanent connections silver brazed.

Precision Regulation . . . Uniform delivery pressure is assured by dual large capacity two-stage Regulators.

REGO

The BASTIAN-BLESSING Company

4201 West Peterson Ave. Chicago 30, Illinois

PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING HIGH PRESSURE GASES

*Reg. U. S. Pat. Off.

JIM LINCOLN and Charlie Davis read copy of *Incentive Management*

Lincoln Pays Workers $4,120,000 Incentive

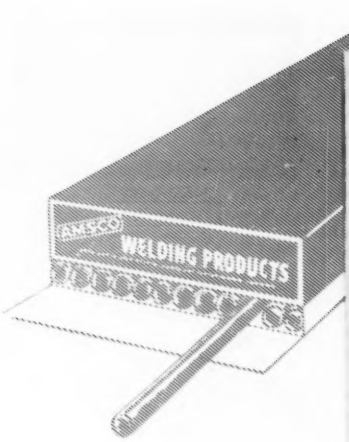
THE middle of December, 1951, saw the payment of $4,121,426 incentive pay to 1,082 employees of The Lincoln Electric Co., Cleveland. The average employee's check was 104% of his regular earnings paid throughout the year. The incentive pay checks brought the average total earnings for a Lincoln worker in 1951 to $7,446. A total of about $300,000 was also allocated by the company for the purchase of annuities for all employees.

Explanation for such exceptional incentive payments is given in a new book just written by James F. Lincoln, president of Lincoln Electric, called *Incentive Management*. He says of incentive pay: "The Lincoln Electric Company calls this reward a bonus. Perhaps this sounds like a gift or profit sharing, but it is neither. The difference is that just being in the company is not a measure of reward as is true in the operation of profit sharing or yearly bonus, as usually handled. In this bonus plan the man is rewarded for all the things he does that are of help and penalized if he does not do as well as others in all these same ways."

* * *

Jefferson to Speak At Edmonton, Alberta

PRINCIPAL speaker at the closing banquet Feb. 29 of the 1952 Welding Show of the Alberta Association of Certified Weldors will be T. B. Jefferson, editor of THE WELDING ENGINEER. The welding show is scheduled for Feb. 27 through Feb. 29 at Edmonton, Alberta. Mr. Jefferson will also speak at a special luncheon for shop owners and managers during the show. Supervising arrangements for the show is J. W. A. deBoer, provincial president of the association.



How AMSCOATING with Amsco Hardfacing Rods saves you materials . . . manpower . . . money.

How to make **short work** of a long shutdown!

AMSCOATING...stands for control of wear by Hardfacing...

Hardfacing rods—and recommendations for their use—are as sound as the manufacturer who makes them. AMSCO has been fighting wear for a half-century—first with Manganese Steel, and later with AMSCO Hardfacing Products.

If you have a problem of wear caused by impact, abrasion, heat or corrosion . . .

Find out how ***AMSCOATING*** *can save you materials . . . manpower . . . money!*

This AMSCOATED Pulverizer Hammer has cut replacements over 90% to date!

Big savings are bound to result when you can reduce shutdowns and replacements. For example, coal pulverizer hammers in a Southern plant were lasting about 5 days before a complicated dismantling job for replacement was necessary. Some hardfacing methods had been tried, but the results still weren't good enough to bring costs down to earth.

Recently test hammers were AMSCOATED with an Amsco Rod specially developed for this type of service . . . and the hammer you see above is now making service life history! Why?

The plant superintendent reports that the AMSCOATED hammers are lasting 14 times longer than plain hammers . . . over twice as long as hammers hardfaced by any other method tested . . . that they've been in service 72 days and are still going strong!

This actual example is one of many AMSCOATING applications that are resulting in *lower* maintenance and replacement costs. . . . *higher* production. Write today for catalog on dollar-saving AMSCO rods and the name of your nearest AMSCO distributor.

AMSCOATING

THE RIGHT WAY TO SAY HARDFACING

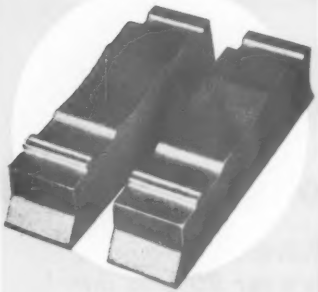
AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

382 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Calif., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.

The DIE is CAST —to Size



...that's why AMPCO WELD* Resistance Welding Dies Save You Time and Money

Just think — when you order "cast-to-shape," "cast-to-size" AMPCO WELD dies, they come to you with tolerances of minus 0, +1/32" or plus 0, −1/32". There's no machining, no time loss. All you have to do is just put in the cap-screw holes — and brother, you're in production.

You also get longer runs and lower costs, because these dies are made of alloys with high physical properties that meet or exceed RWMA specifications. If you're interested in longer runs for your money, place your order now for AMPCO WELD "cast-to-size" dies.

. . . and Ampco Engineering Service when you need it

Behind the famous AMPCO WELD line of resistance-welding products is a corps of experienced engineers, ready to help you solve your problems. Prompt service from these men is yours whenever you need it. Just get in touch with us.

RW-4

Ampco Metal, Inc.
Dept. WB-2, Milwaukee 46, Wis.
West Coast Plant: Burbank, California

AMPCO

It's Production-Wise to Ampco-ize!

*Reg. U. S. Pat. Off., Ampco Metal, Inc.

High Nickel Steel Output Sharply Reduced

To conserve nickel, steelmakers have cut back the output of high nickel steels, says the American Iron and Steel Institute. The same goes for molybdenum and chromium steels, as steel men seek to broaden the use of boron alloys where the former were used.

The output of the four grades of alloy steels, the nickel, moly, nickel-chromium and nickel-moly grades, declined 22 to 64% in the first 10 months of this year, from the comparable part of 1951. Meanwhile, the output of all alloy steel ingots totaled 7,095,518 tons, an increase of 21%.

At the same time, a sharp rise was made in the output of grades of alloy steel using smaller quantities of the critical elements. The output of nickel-chromium-moly steel was more than 1,800,000 tons, an increase of 86% in 10 months.

The development of boron steels will have to be pushed rapidly to conserve shrinking supplies of nickel, chromium, etc. Boron, which occurs widely in this country, is added to steel in small amounts to harden it. Main reason why many people haven't used it more widely is the variability in successive batches of boron steel and the unfamiliar forming, machining and working characteristics of boron steel products.

* * *

Overseas Business Services Told in McGraw-Hill Booklet

VALUABLE services to American business firms established overseas or to those interested in foreign markets are offered in a new booklet, *Overseas Business Services*. Published by the McGraw-Hill International Corporation, 330 West 42nd St., New York 36, it tells how a staff of foreign and business trade experts in 70 countries are at the disposal of American clients. In addition Overseas Business Services maintains a New York staff of specialists in all phases of foreign trade and operates a special translation unit.

For foreign clients, the research division has on call a nation-wide staff of more than 400 investigators. Examples of jobs performed include a survey to determine the feasibility of branch plant operations in Brazil, a study of production for the ECA in France, a survey of the oil market in Colombia, a media study in the near East, movies of a U. S. owned plant in Egypt, an industrial feeding survey in the U. S. and an air passenger traffic analysis in Latin America.

Mk-h 100%
Pk-h 100%
Se 100%
Tr 100%
ED 100%

THE FORMULA THAT ALWAYS MAKES GOOD

All-State

ALLOYS AND FLUXES FOR WELDING BRAZING SOLDERING TINNING CUTTING

It's the formula that accounts for the high rate
- in application speed
- in uniformity
- in operator training
- in dependability
- in quality

which characterize the wide use of ALL-STATE Alloys and Fluxes.

It's the formula we use continuously. Interpreted:
Mk-h — Metallurgical know-how
Pk-h — Practical know- how
Se — Service
Tr — Training
ED — Excellent Distributors

A-S DISTRIBUTORS *EVERYWHERE*

Ask for a free copy of 32-page Buyers Guide to the complete line of ALL-STATE Alloys and Fluxes.

ALL-STATE
WELDING ALLOYS CO., INC.
White Plains, N. Y.

Give Grinding Wheels Proper Inspection, Care

IT PAYS to take care of your grinding wheels from the moment they arrive on your shipping dock, advises *Grits and Grinds*, Norton Company house organ. First, look over the shipping container carefully—even slight damage may indicate a cracked wheel, or it may not, but look anyway. It's even possible that the wheel is damaged because of abuse in transit, but the container won't have a mark.

After opening the container, don't dump the contents on the floor. Lift the wheels out of the sawdust packing material while the box is upright and give them a visual check for cracks chips and other breaks. The wheel should then be given a ring test.

Storage is extremely important, too. When not in use, wheels should always be kept on special grinding wheel storage racks. This applies to used wheels too. Grinding wheels should be stored in a dry area, in rooms not subject to extreme temperature changes. Some bonds are seriously affected by dampness and temperature changes. The importance of dry-area storage cannot be overemphasized. Racks should never be placed where passing cranes, lift-trucks, tote boxes, etc. can jar or hit them.

Separate sections for each type of wheel should be built, if possible, so that each can be adequately reinforced for the particular weight of wheel. In addition, this provision makes it easier to construct rails or lips to prevent each diameter and size of wheel from rolling off.

* * *

Saginaw Welding Holds Clinic

SPECIALIZED instruction in arc welding, tool and die welding, hard-facing and inert-arc welding were offered in December at a welding clinic held by Saginaw Welding Co., Saginaw, Mich. Other subjects demonstrated or discussed by authorities were atomic hydrogen welding and metal spraying.

Hosts Jim and Rose Alcock greeted customers and guests at the three hour afternoon session and the four hour evening show.

Instructors at the clinic included Bob Bercaw, head of the Hobart Bros. trade school, Troy, O.; Pat Doyen, welding engineer, Welding Equipment & Supply Co., Detroit and Jim Glander, welding specialist, Sight Feed Generator Co., West Alexandria, O.

WAGNER

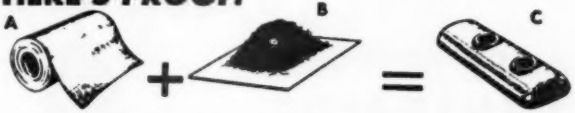
ELECTRODE HOLDERS

WITH *IMPROVED* "COPPERHEAD" INSULATOR TIPS

INSURE ADDED

ECONOMY in Welding

HERE'S *PROOF:*



1st a heavy Woven Glass Fabric, (Fig. A) provides cover protection to insure the impact strength necessary to withstand the shock of dropping and tough operating conditions.

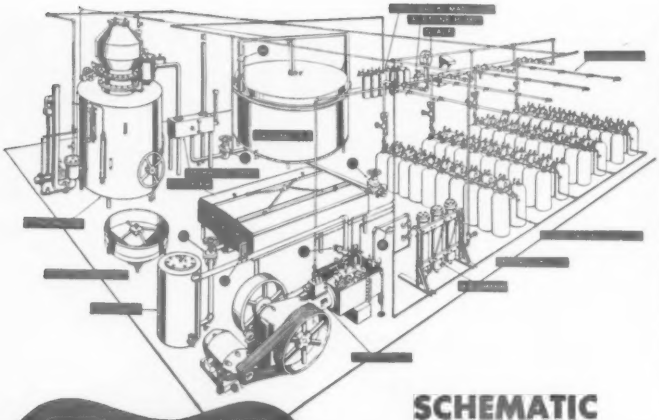
2nd Long Asbestos Fibres, (Fig. B) insure greater protection against radiated heat of the arc, as well as providing impact strength, and adequate electrical insulation.

3rd Plastic Resin of extreme heat-resisting qualities bond "A" and "B" together to provide protection against high temperatures and pressures, with the result that these improved "COPPERHEAD" Insulating TIPS make the WAGNER ELECTRODE HOLDER the most practical and economical to use.

WAGNER WELDING PRODUCTS *are the result of more than thirty-three years of experience in welding and practical knowledge of mechanical and electrical engineering. WAGNER products are sold only through Welding Supply Dealers, or write us direct for further details.*

WAGNER MANUFACTURING CO.

230 W. 1st SOUTH ST. JACKSON, MISSOURI



A *Low Pressure*
ACETYLENE
PRODUCING
PLANT
that Charges up to
160 CYLINDERS
at ONE TIME

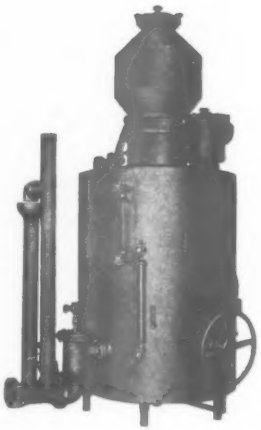
SCHEMATIC PLANT ASSEMBLY

SHOWING LOCATION OF UNITS THAT MAKE UP THE PLANT

This plant layout provides simplest operation at low production costs. Compact design allows operator to watch all operations at all times.

LOW PRESSURE
GENERATOR

This 600-lb. acetylene generator fits into the above plant assembly. It stands out as one of the safest plants manufactured. Automatic controls minimize operating personnel. Rated capacity of the generator and plant assembly is 2700 cu. ft. per hour. The other units are designed for maximum production at minimum costs.



WE INVITE YOUR INQUIRIES

INDEPENDENT ENGINEERING COMPANY, Inc.
Manufacturers of
CONSULTING · DESIGNING · RESEARCH
CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE - OXYGEN - HYDROGEN - NITROGEN
O'FALLON 5, ILLINOIS

MASSIVE generator part is welded easier with big positioner's aid

Big Table Aids Welding on Generator Part

UNDERGOING fabrication in Allis-Chalmers tank and plate shop (see above) is this center section of the low-pressure cylinder for a big steam turbine generator. The generator is the first of two 120,000 kw, 3600/1800-rpm cross-compound units for Wisconsin Electric Power Company's new $100,000,000 Oak Creek power plant in the southeast corner of Milwaukee county.

A huge 50-ton motorized positioning table can be seen below the welders, helping them to lay downhand welds. The table can be adjusted at any tilt between the horizontal and straight up. It will rotate pieces as large as 27 ft in diameter at a table rim speed of from 8 in. to 20 ft per minute.

* * *

Allis-Chalmers Research Directed by One Division

ALL research projects for the general machinery and tractor divisions of Allis Chalmers Mfg. Co., Milwaukee, are now directed by the research division, says Dr. Harry K. Ihrig, vice-president in charge of research. The division also coordinates all research in the company's branch palnts.

Assistant to Dr. Ihrig in charge of administrative duties, personnel and liaison for the entire division is J. T. Jarman, who also supervises the physical testing and heat treating sections.

A. K. Higgins and Will Mitchell, Jr. are assistant directors of research. The former is in charge of the metallurgical, chemical, melting, precision casting sections and the physics laboratories. Mitchell is in charge of the process, air-flow, pump, blower and condenser laboratories.

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*PENOPTIC is the trade name of Pennsylvania Optical Company

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resists cracking down to very short stubs

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PAGE WELDING RODS

Check Outmoded Machinery for Much-Needed Scrap

In answer to the "shortage" of scrap, R. W. Wolcott, chairman of the American Iron and Steel Institute's scrap committee made some interesting points recently in *Factory Management and Maintenance*, a McGraw-Hill publication. Two-thirds of the scrap for steel mills must come from "obsolescence" scrap, said Wolcott, that is, from machines, tools and equipment saved for a potential use that never comes up. Only one-third of the scrap mills use comes from so-called "prompt industrial" sources (tonnage shipped back relatively quickly by users of steel products).

Though people have seen junk yards with towering piles of scrap, it doesn't mean they're hoarding it for higher prices. Actually, according to recent figures, only a million tons of scrap are in yards at the present time—about two weeks supply.

Hundreds of spot checks made by the AISI show that few, if any of the thousands of plants in this country have gotten rid of all "obsolescence" scrap. The superintendent has slipped the old machine into a corner somewhere with the idea its parts will come in handy some day.

* * *

Welded Pipe to Carry Submarine Cable

The world's first 230,000-volt submarine power cable will be laid across Puget Sound north of Seattle in a welded 10-in. diameter pipe. Part of the Bonneville Power Administration plans for the area, the cost will be $6,107,000.

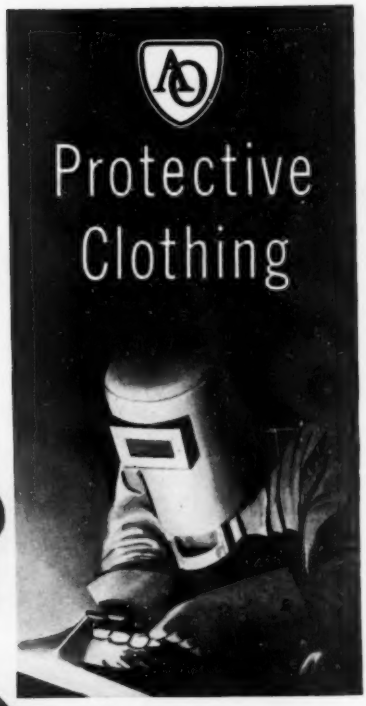
The cable would extend 5½ miles from the Bonneville substation at Snohomish to the Olympic peninsula where Bremerton and the Puget Sound Navy Yard are located.

The cable inside the pipe will be surrounded by oil under 200 psi pressure. To counteract salt water corrosion, the outside of the pipe will carry a heavy mastic coating.

* * *

Flash Welding Consultant Opens for Business

Flashweld Industries, 9400 West Belmont Ave., Franklin Park, Ill. (near Chicago) has been formed to provide the welding industry with specialized information on flash welding. E. A. Sirabian will direct all technical activities of the company which include contract jobbing, tooling of customer's equipment or research on special assignments in flash welding.



AO 5X163
GLOVE

Exceptionally Resistant to Heat...

YET AMPLY FLEXIBLE ON THE JOB!

This chrome-tanned split horsehide welder's glove is highly recommended for exceptional resistance to heat. IT WILL GIVE PROTECTION ON GAS WELDING AND THE HEAVIEST AMPERAGE ELECTRIC WELDING. The leather is top quality and tanned to take the hardest wear while remaining soft and flexible for working comfort. Your nearest AO Safety Products Representative can supply you.

QUICK FACTS

- One piece back and palm
- Welted at all vulnerable seams for added protection
- Extra heavy lining on back of hand helps prevent chafing, absorbs perspiration — gives extra comfort.

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SAFETY PRODUCTS DIVISION

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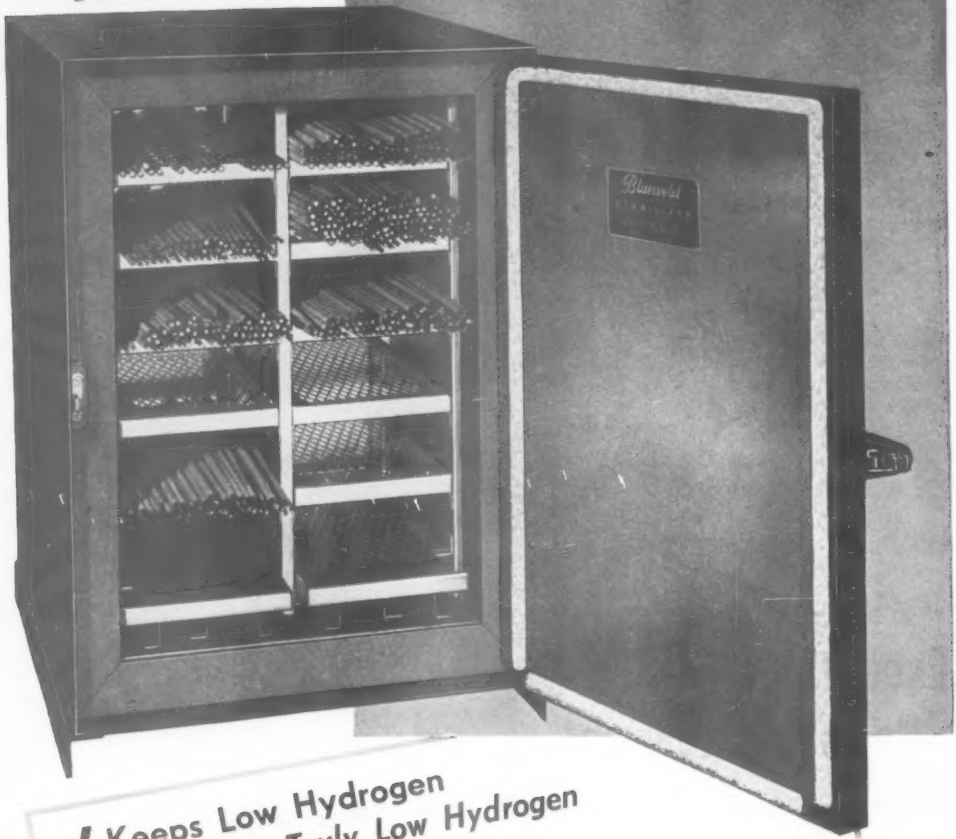
Essential to Low Hydrogen Welding...

Blueweld LO-HYDROGEN ELECTRODE

STABILIZER



✓ Keeps Low Hydrogen Electrodes Truly Low Hydrogen

✓ Chimney Type Ventilation

✓ No Dead Air Spaces... Electrodes are always surrounded by Moving, Heated, Dry Air

✓ Pre-Set Thermostat Stabilizes Moisture Content by maintaining proper temperature

Stacking Feature Provides Wide Capacity Range

Model 400 Blueweld STABILIZERS may be stacked or grouped to provide any capacity range from 400 lbs. to 40,000 lbs., or more. As each unit is individually heated, capacity is readily and economically adjusted to varying requirements.

Voltage (Specify when ordering) 115 or 230 Volts Standard, 440 Volts Special

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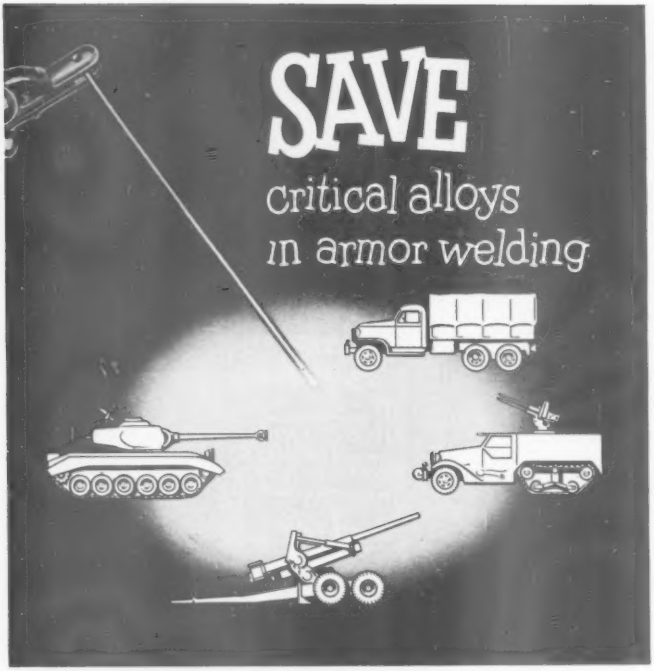

Arcos Low Hydrogen Electrodes replace Stainless for sound armor welds

ARCOS LOW HYDROGEN ELECTRODES
Tensilend 70
Tensilend 100
Tensilend 120
Manganend 1M
Manganend 2M
Nickend 2
Chromend 1M
Chromend 2M

For over a year, Arcos Low Hydrogen Electrodes have been successfully producing sound welds on armor that meet the most critical specifications. This practical application has proved how quantities of scarce nickel and chromium can now be saved to meet other urgent defense requirements.

Since 1942 Arcos has produced low hydrogen electrodes to the same rigid quality controls applied to Stainless. Now offering the most complete selection in the low hydrogen field, Arcos electrodes assure you of consistently uniform welding performance on armor as well as on industrial applications.

ARCOS CORPORATION
1500 South 50th Street • Philadelphia 43, Penna.

WELD WITH

ARCOS

Specialists in Stainless, Low Hydrogen and Non-Ferrous Electrodes

Society to Spend $400,000 on Eye Safety This Year

AN intensified program of promoting good eye-health and eye-safety measures in industry will be pushed strongly this year by a $403,359 budget planned by the National Society for the Prevention of Blindness.

Dr. Franklin M. Foote, executive director, revealed that during the past year the society has been conducting a survey of eye health and safety measures in iron foundries in coöperation with the Gray Iron Foundries' Society.

A 65% gain in membership of the Society's Wise Owl Club during 1951 was reported by Dr. Foote. To become a Wise Owl, a worker must prove, usually by showing his damaged safety glasses, that his sight was saved by wearing them. He receives as a token of his membership a small pin to wear on his overalls. This pin reminds other workers in the plant that eye accidents can happen anywhere at anytime.

• • •

Pennsalt Metal Cleaners Plant on West Coast

PENNSYLVANIA Salt Manufacturing Company of Washington (State) has begun operations in a new plant at Portland, Ore. It manufactures a complete line of specialty metal cleaners for welding, galvanizing, electroplating, enameling, painting, alumnium anodizing and etching as well as cleaners for the transportation, industrial and general maintenance fields.

Sales-service organization for the industrial cleaners made by Pennsalt of Washington is under William J. F. Francis, sales manager of Pennsalt's western specialty chemicals division.

"Stop dating that mermaid and start a little welding!"

Big California Weld Shop for Westinghouse

A 25,200 sq ft welding building will be finished this year at the western headquarters plant of Westinghouse Electric Corp. at Sunnyvale, Calif. The new weld shop plus a machine shop and a storage building will make the plant seventh largest in working area of all Westinghouse plants, with a total floor space of 1,162,000 sq ft.

The weld shop is 420 by 60 ft. The exterior, in California redwood color, is painted with a plastic coating about a third of an inch thick that will expand and contract under temperature changes. Contractor for the welding building is J. H. Pomeroy, San Francisco.

* * *

New Los Angeles Building for Black & Decker

OCCUPATION of a handsome new business building on Los Angeles' South Broadway was announced by the local sales and service branch of The Black & Decker Mfg. Co. in January. It includes greatly expanded service repair and stock room space and a modern show room for portable electric tools. An L-shaped parking lot with two entrances should help customers with parking worries.

The factory-trained service personnel under service engineer R. A. Lomas will be equipped with the finest service facilities for tools in southern California, Arizona and southern Nevada. Waldo E. Bair is Los Angeles branch manager.

* * *

New M&T Distributors . . .

RECENTLY announced as distributors of Metal and Thermit Corp. welding equipment are the following firms: Dilworth of Alabama, in Tuscaloosa; Middleton Welders Supply Co., San Leandro, Calif.; Georgia Supply Co., Jacksonville, Fla.; Pye-Barker Welding Supply Co., Atlanta, Ga.; Shaffer & Co., Brazil, Ind.; Mittler Supply, Inc., South Bend, Ind.; Delta Oxygen Co., Baltimore, Md.; Industrial Equipment & Supply Co., Benton Harbor, Mich.; Sierra Oxygen Co., Reno, Nevada; Edmac Welding & Tooling Supply, Winston-Salem, N. C.; A. H. St. Louis Co., Utica, N. Y.; Fayette Oxygen & Supply Co., Uniontown, Pa.; Noland Co., Inc., Norfolk, Newport News and Roanoke, Va.; Welders Gas & Supply Co., Sioux Falls, S. D.; Denton Tire & Supply Co., Galveston, Tex.; T&T Welding Supply Co., Big Spring, Tex.; Hendrix Welding Supply, Lubbock, Tex. and Bentley Sales Co., Racine, Wis.

ARCOS Stainless Electrodes pass rigid quality control tests before you receive them

Every time you weld with Stainless Electrodes, you want to be sure that the weld metal produced will be consistently of the highest quality—physically, chemically and metallurgically. Getting results like these can be guaranteed only through constant testing and retesting of every batch of electrodes manufactured. Arcos control specifications are the most rigid in the industry, and that's why every Arcos Stainless Electrode you use will deliver improved welding performance at lower welding costs.

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WELD WITH ARCOS

Specialists in Stainless, Low Hydrogen and Non-Ferrous Electrodes

New WELDING IMPROVEMENT ASSURES

GREATER CONTROL OVER WELD POWER

WITH

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LO CONDUCTIVITY

Robotron "CUSHIONED POWER" WELDING TIMERS

THE PROBLEM: To help manufacturers meet more and more exacting specifications issued by government and civilian buyers in the welding of Aluminum, Stainless and Nickel-Alloy Steels, Coated or Plated Metals, or any combination of Dissimilar Metals regardless of conductivity.

To design new, compact electronic controls that can be added to your old or new welding equipment with ease.

To increase welding production at lower cost.

Robotron's ANSWER: A new concept of Vernier Control, the Robotron "Cushioned-Power" Welding Timer pre-heats and prepares the welding material, welds and tempers according to specific needs, assuring welds of minimum surface indentation, maximum ductility and consistant uniformity.

- It welds all combinations of Hard-to-Weld, Plated or Dissimilar Metals.
- Reduces Weld Power KVA (heat) demand and usual required Electrode Pressures.
- Reduces Metal Spewing, Cracking and Surface Indentation.
- Reduces Electrode Pickup and Cleaning Time.
- Cushions impact on Welding Lines — Adds life to Electrodes.
- Can be Added to your present Welding Equipment.
- Can be used in Single-Phase Welding.
- Reduces overall Welding Costs.

Factory time-tested and proven like all other Robotron Electronic Control Equipment, this new "Cushioned-Power" Welding Timer features Compactness, Maximum Accessibility, Easy Installation, Easy Maintenance and Finger-Tip Modulated Power Control. Investigate how Robotron "Cushioned-Power" Welding Timers can increase YOUR welding production — No Obligation, of course.

MODEL W630—H3C4
NEMA 7B Sequence — 1A Synchronous Timer with "Cushioned-Power" Control and 600 Ampere Ignitron Contactor.

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Book Reviews

Steel Making

THE MAKING, SHAPING AND TREATING OF STEEL, Sixth Edition. J. M. Camp and C. B. Francis. Published by United States Steel Co., Pittsburgh. 1951. 1,435 pages. Price $7.50, $5 for schools and colleges.

Scientific advances in the steel industry during the last ten eventful years are covered fully for the first time in a new edition of U. S. Steel's book, *The Making, Shaping and Treating of Steel.* The new edition, in preparation more than two years is based on the original text by J. M. Camp and C. B. Francis.

Experts and authorities in each steelmaking field were called in to prepare the new book. It is presented in 38 chapters, subdivided into sections. With more than 23,000 listings, the index of the sixth edition is cross-referenced and covers 148 pages of the 1,435 page book. Most of the 713 illustrations are new and were selected to provide clarity and detail.

Subjects that have been completely revised and expanded include refractories, pig iron, the Bessemer Process, open hearth, electric furnace steel, merchant bar production, hot strip mill products, manufacture of tin plate including an entirely new section on the electrolytic process, principles of heat treatment of steel, mechanical testing and gage numbers.

Orders for the book will be received by the treasurer, United States Steel company, 525 William Penn Place, Pittsburgh 30.

* * *

New Products

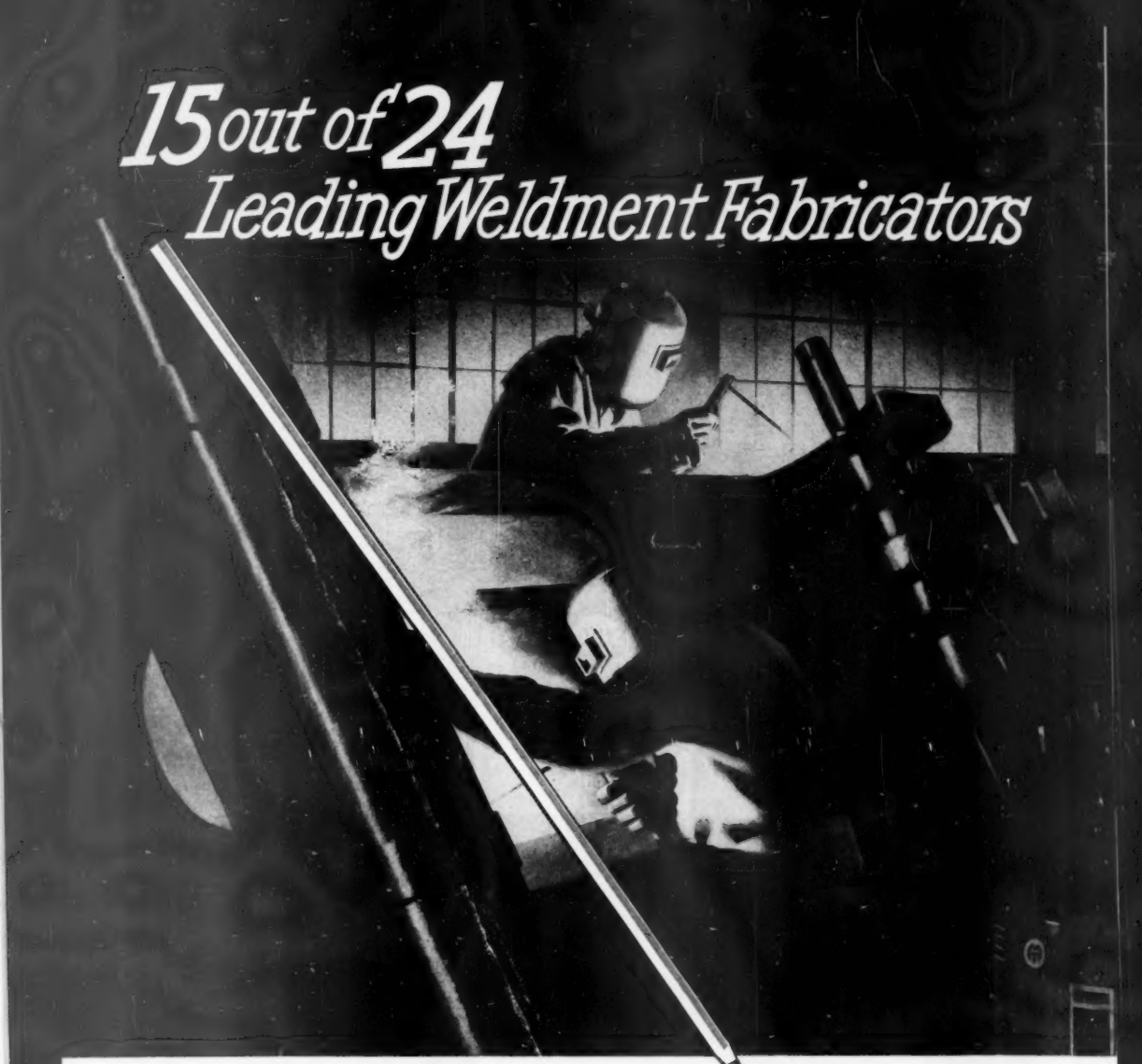
NEW PRODUCTS AND SERVICES. Published by The New York Journal of Commerce, 1952. Paper, 80 pages. Price 50c.

America's men and factories apparently don't let a defense situation stifle new and different products and services. Everything from electronics devices to self-watering flower pots is listed in this 80-page round up, published annually by the N. Y. Journal of Commerce.

Most prominent interest this year is television, not only new sets, but viewing aids, highlight controls and custom-built unique additions. A "telejector" makes it possible to screen TV spots and shows in the offices.

Industrial products asking for attention are a variety of forklift trucks, a portable five pound stud driver, several hardening compounds for steels, permanent magnets made of non-critical materials.

15 out of 24 Leading Weldment Fabricators



*Among the twenty-four *top contract welding firms, fifteen regularly weld with Murex Electrodes.*

More of the leaders in important industries prefer Murex Electrodes in their welding operations because they can be sure of sound welding—high deposition rates for economy and speed of production.

*Those having AAAA directory ratings.

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About People

WESLEY S. WALKER, on leave from Linde Air Products Co. as nitrogen product manager, has been named director of the general industrial equipment division, NPA. He will be responsible for distributing allotments of steel, copper and aluminum under the Controlled Materials Plan to manufacturers. Mr. Walker, who has been with Linde Air Products Co. for 25 years, replaces WALTER E. SCHIRMER, vice president of the Clark Equipment Co.

* * *

JOSEPH H. HUMBERSTONE has been elected a vice president of Air Reduction Co., Inc. He was formerly the president of the company's Airco equipment manufacturing division. During his years with Arcrods Corp., he was outstanding in electrode research and development. He has been succeeded as equipment president by S. D. Baumer.

* * *

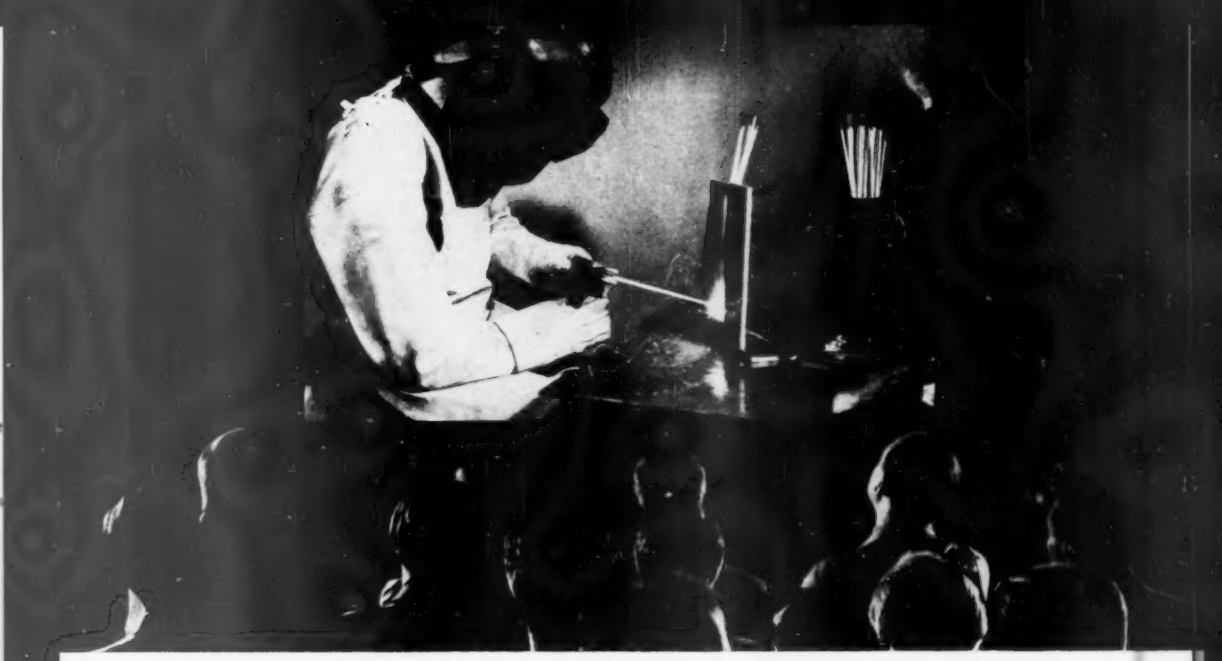
PAUL B. ANDREWS succeeds JOSEPH W. MULLALLY in position of deputy director of the copper division in the metals & minerals bureau of NPA. Mr. Andrews has been chief of the brass mill branch in the copper division. He is on loan to the government from Revere Copper & Brass, Inc.

* * *

DR. FRANCIS C. FRARY will retire as director of research for Aluminum Co. of America. Dr. Frary joined Alcoa in 1918 and organized Aluminum Research Laboratories at New Kensington, Pa. He holds more than 30 U. S. patents and is author of numerous books and papers on metallurgical and chemical subjects.

* * *

FRED L. NONNENMACHER has been named manager of Chicago district sales of the American Steel & Wire Co., succeeding E. A. MURRAY, resigned. Taking Mr. Nonnenmacher's place as manager of the manufacturer's products sales department in Chicago is S. W. GOODENOUGH, while R. H. HAUGHER succeeds Mr. Goodenough as assistant manager of manufacturers' products sales.



Train Your Operators Better and Faster with G-E's Movie "The Inside of Arc Welding"

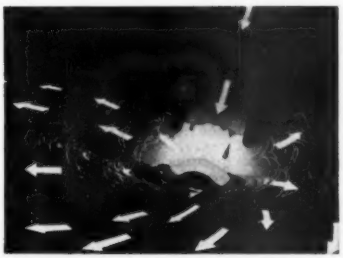
Full Color and Sound Movie Speeds Training Programs up to 20%

Teach beginners the fundamentals of arc welding quickly with the color movie, "The Inside of Arc Welding." Produced during World War II, this movie speeded up training of operators as much as 20 percent. The film enables instructors to give even the largest classes many of the advantages of individual attention.

Authentic photographs and animated cartoons show all details of the arc-welding process: current setting, angle of electrode, length of arc, electrode travel speed. You can see good and bad welds in cross section, and watch experienced operators demonstrate principles of arc welding in *all* welding positions.

In Six Parts—each part 10 minutes and complete in itself (16mm color and sound)

1. *Fundamentals*
2. *Flat position*
3. *Horizontal position*
4. *Flat and horizontal with AC*
5. *Vertical position*
6. *Overhead position*



Animated drawings illustrate the arc and molten pool in terms easy for the beginner to understand

You Can Buy These Films at Cost for your Training Programs. "The Inside of Arc Welding" costs only $55 per part, or $330 for a complete set of six parts. "The Story of AC Welding" costs $95 for Part I and $105 for Part II. Write to Section 712-14, General Electric Company, Schenectady 5, N. Y.

You Can Borrow Prints, free of charge, for single showings. Just get in touch with your authorized G-E Welding Distributor. You can find his name by looking for General Electric under "Welding Equipment" in the yellow pages of your telephone directory.

"THE STORY OF AC WELDING"

Shows You Why AC Is Best for Three out of Four Welding Jobs!

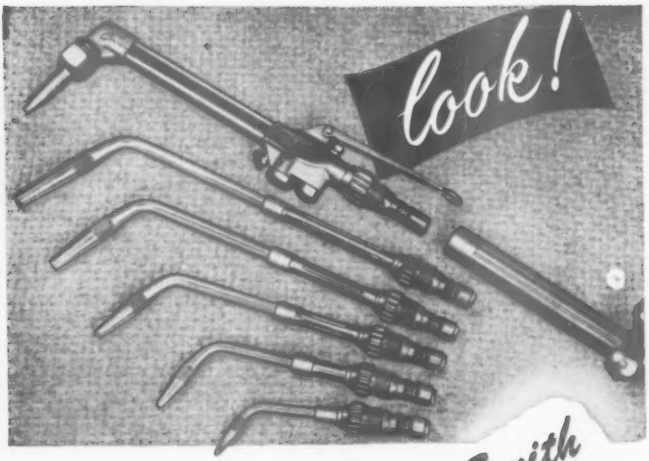
"The Story of AC Welding" explains how you can improve weld quality, increase welding speeds and reduce costs with AC welders.

You see clearly, by means of actual photographs and animated cartoons, why and how AC eliminates troublesome arc blow. You see the arc's action in corners, angles and intersections. The arc and molten pool are shown in close-ups. Part I shows actual operation of the arc while Part II shows advantages of AC. Each part is in full color and sound.

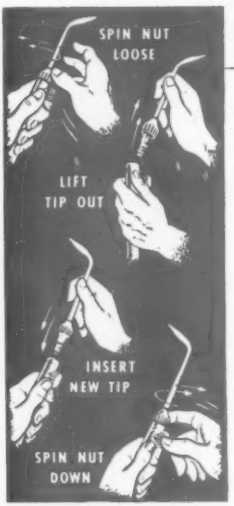
The film shows the causes and effects of troublesome arc blow, and how AC eliminates it.

GENERAL ELECTRIC

712-14



You can change these Smith 1 Tips in 6 Seconds



- No wrench necessary
- Fingers do the job
- Fast line-up of tip
- Fast change from welding to cutting

How do you like that for fast, efficient operation? No searching for wrenches—no wasted time. Just use fingers only. In actual demonstrations, operators have been able to remove and replace 4 tips in the time another operator could remove and replace 1 tip in an old fashioned model. And the seal stays tight even if tip is battered or nicked!

This is the kind of progress modern industry needs and wants. But it's not the only advantage you get with this new Smith equipment. Note that the Cutting Assembly can be attached just as quickly as a tip and the new "FLO-TROL" feature eliminates reverse flow of gas—prevents burned out seats. Keeps torch on the job . . . does away with costly delays. Another ingenious feature permits rotating the tip **while flame is burning!** (Heavy Duty Torch Body and Cutting Assembly, illustrated above, carries Lifelong Guarantee).

THAT'S ALL! . . . JUST 6 SECONDS; IT'S NEW AND REVOLUTIONARY

MAIL COUPON TODAY FOR DETAILS

SMITH WELDING EQUIPMENT CORPORATION

Manufacturers of fine Welding Equipment for over 40 Years

Smith Welding Equipment Corporation
2635 S.E. 4th, Minneapolis, Minn.

Please send me more information on the time-saving and money-saving features of your new torch.

Name_____

Address_____

City_____ State_____ WE-14

DR. KENT R. VAN HORN, 46, associate research director of Aluminum Company of America will become director upon the retirement of DR. FRANCIS C. FRARY, present head of Alcoa Research. Dr. Van Horn is co-author of *Practical Metallurgy* with Dr. George Sachs and *Alloys of Iron and Aluminum*, scheduled for publication this year. An authority on industrial X-ray procedures, Dr. Van Horn is a member of 10 technical societies and in 1944 served as the youngest president ever elected for the American Society of Metals.

* * *

ROSS BAZE, west coast sales manager for Black, Sivalls & Bryson, Inc., will be in charge of the company's new San Francisco office, locally assisted there by WARREN J. MAY, sales engineer.

* * *

J. H. KING, vice-president of The Babcock & Wilcox Co. has been named to head the reorganized boiler division of the company. LUKE E. SAWYER and EDWARD A. LIVINGSTONE, president and vice-president of the recently absorbed subsidiary Tube Company have been elected vice-presidents of Babcock & Wilcox.

* * *

ALFRED L. BOEGEHOLD, former head of the General Motors Research metallurgy department, has been appointed assistant to the general manager of the research laboratories division. He succeeds E. V. RIPPINGILLE, SR., whose retirement becomes effective Feb. 1.

* * *

ROBERT S. MERCER has joined Pennsylvania Salt Mfg. Co. as sales engineer on corrosion resistant products.

* * *

WALTER H. WIEWEL has been appointed Assistant Administrator of NPA, in charge of the metals & minerals bureau. Mr. Wiewel, who was with WPB in the last war, is on leave from his post as vice president of sales for the Crucible Steel Co. of America, Pittsburgh.

* * *

WILLIAM G. WHYTE has been named assistant director of public relations, Chicago district, of United States Steel. He succeeds PAUL THIXTUN, who has been promoted to director of public relations for United States Steel at Louisville, Ky.

* * *

NELSON S. COBLEIGH has been appointed district manager of the Philadelphia sales division of Ampco Metal, Inc. He was formerly field engineer in the Wisconsin office.

Three HAYSTELLITE inserts protect each of the blades on these two pug mill screws from the abrasive action of linoleum ingredients.

A handful of Tungsten Carbide Inserts gave this mixer an Extra Year of Life

Masticator blades in this pug mill-type mixer for processing linoleum failed in less than three months, because of severe abrasive wear. Much of this wear was eliminated by tack-welding three HAYSTELLITE cast tungsten carbide inserts to each of the blades on the screw. The inserts were applied easily without removing the blades from the mill.

After it was equipped with hard-faced blades, the mixer remained in service for nine months without blade maintenance, and it was still good for six months more. This five-to-one life more than offsets the cost of the inserts.

For more information on HAYSTELLITE tungsten carbide products and seven other HAYNES hard-facing materials, write for the 40-page booklet, "HAYNES Alloys—Hard-Facing Manual." The booklet contains data on how to select the right rod and how to make the deposit by either the oxy-acetylene or metallic-arc welding process.

HAYNES TRADE-MARK *alloys*

"Haynes" and "Haystellite" are trade-marks of Union Carbide and Carbon Corporation.

Haynes Stellite Company
A Division of
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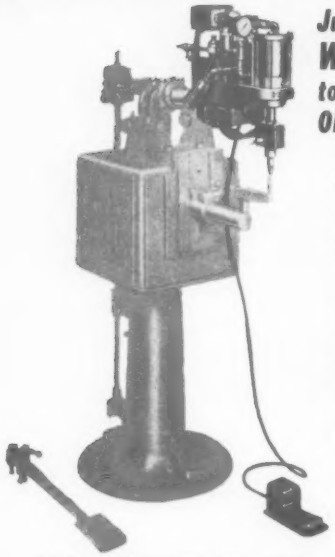
MORE SPEED than You Need—



Just Add WELD-AIR-MATIC to your Old Rocker Arm Welders

Your present rocker arm spot welders can *really* produce *extra* profits—for all it takes is the simple installation of a compact Weld-Air-Matic. This self-contained control unit *air-powers* your welder—adds *speed, accuracy, ease of operation* never before possible with your present foot-operated welder.

Tests Prove 10,000 Welds Hourly on Continuous Daily Schedules

The Weld-Air-Matic provides a feather-touch foot switch that controls pressure and energizes a coil on a four-way operating valve. Employing reduced air pressure of 15 to 50 lbs., it has a maximum stroke of 1½" on size 1 unit, 2" on size 2, and 2½" on size 3 unit. Requires any standard Weld Timer and a minimum of 4 cubic feet air supply per minute, with 80 lbs. minimum line pressure. Three sizes available with all accessories mounted to one strong aluminum alloy casting.

Get the facts now on how you can break all previous production records of your present equipment, by modernizing with the new Weld-Air-Matic. You can't lose—for the savings you make will quickly account for Weld-Air-Matic's nominal cost.

DEALER TERRITORIES AVAILABLE
Information on Request

WRITE TODAY FOR DETAILS

ROBT. W. HOFFMAN COMPANY, INC.
40 South Clinton Street **Chicago 6, Illinois**

For Slag-Free Welds and Complete Fusion

Clean with CMD CHIPPING HAMMERS

Note above how improper cleaning has left slag in the seam, resulting in poor fusion.

Note the complete fusion and good penetration which result when a weld is properly cleaned.

CMD TYPE CB HAMMER
A favorite for many years, this hammer with wood handle is 3 tools in one—drift, chisel and wire brush.

Experienced weldors know that to have strong welds all slag must be removed after laying each bead. For this job many prefer a CMD Tri-Purpose Chipping Hammer such as the CB shown here or the EB or FB which have steel handles. Ask your dealer to show you the complete CMD line.

Write for descriptive circular W-9 and FREE 16 page Booklet "How to Clean Welds".

CHICAGO MANUFACTURING & DISTRIBUTING CO.
1928 WEST 46th STREET • CHICAGO 9, ILLINOIS

Died . . .

RICHARD A. METCALF, 42, sales manager of Miller Electric Mfg. Co., Appleton, Wis. passed away Dec. 20. He came to work for Miller in 1943 after being with National Cylinder Gas Co. He traveled the Wisconsin, Minnesota, Dakota and upper Michigan territory for Miller until his promotion to assistant sales manager in January, 1951. In October, 1951, he was made sales manager. He is survived by his wife Mildred.

• • •

JAMES A. RAFFERTY, vice-president and director of Union Carbide and Carbon Corp., died in Ft. Lauderdale, Fla., Dec. 19 at the age of 65. He was a pioneer in the development of the synthetic organic chemical industry in the United States. During World War II he was executive official in charge of Union Carbide's part in the atomic energy and synthetic rubber programs.

• • •

ROBERT J. KEHL, consulting engineer in the development department of Linde Air Products Co., died Nov. 23 at the age of 62. He was an authority on acetylene generators and was noted for his achievements in the development of all types of oxyacetylene apparatus. He joined the engineering staff of the Chicago plant of Oxweld Acetylene Co. in 1913 and later became chief engineer of the company, now part of Linde. He wrote two textbooks, *Oxyacetylene Welding* and *Oxyacetylene Welding Practice* as well as many articles. His memberships included the American Welding Society, International Acetylene Association and the ASME.

• • •

OSCAR A. KNIGHT, 72, a retired Detroit district manager in the Grinding Machine Division of Norton Co., died December 17 in Michigan. He began work with Norton Co. in 1905 and at height of his career, was considered an outstanding grinding machine technician.

• • •

CALVIN STERLING, head of the analytical section of International Nickel Co., Inc., research lab, Bayonne, N. J., passed away Oct. 1. Associated with The International Nickel Co. since 1925, Mr. Sterling participated actively with ASTM since 1937.

Value Beyond Expectation!

Mallory "Nu-Wrinkle Cap"* Electrodes

(cross-section of fluted water hole)

Conserve Copper Alloy... Cut Resistance Welding Costs

The Mallory "Nu-Wrinkle Cap" Electrode is composed of a replaceable cap inserted into a reusable shank. When the face is no longer serviceable, it is necessary only for the operator to replace the relatively small and inexpensive cap.

Extensive spot welding tests have shown that, in most applications, the performance of Mallory "Nu-Wrinkle Cap" Electrodes compares favorably with that of conventional one-piece electrodes, resulting in a considerable reduction of electrode costs and saving of critical copper alloy.

Caps are available in all standard Mallory nose types, in Elkaloy A† or Mallory 3† metals, with #1 or #2 Morse Taper shanks. All shanks have fluted** water holes, increasing the cooling surface area by 70% compared with round holes.

In addition, Mallory "Nu-Wrinkle Cap" Electrodes make readily replaceable inserts for die applications.

That's value beyond expectation!

Get complete information now. Write direct or contact your local Mallory Distributor.

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry St., Toronto 15, Ontario.

Outstanding Design Features of Mallory "Nu-Wrinkle Cap" Electrodes

1. Smooth, annular corrugations of cap skirt provide positive electrical and thermal contact with shank.
2. Resilience of corrugations effects secure attachment of cap to shank.
3. Wiping action of corrugations cleans adjoining surfaces of shank, assures low electrical contact resistance.
4. Hollow cap skirt has the largest practicable cooling area, results in a maximum rate of heat transfer.
5. Smoothly rounded skirt corrugations minimize damage to shank, insure maximum shank life.
6. Unique design eliminates possibility of cap being forced askew into shank.

*Trade Mark, Patent Pending
**Patent Pending
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Resistance Welding Electrodes, Holders, Dies, Rod and Bars, Castings, Forgings

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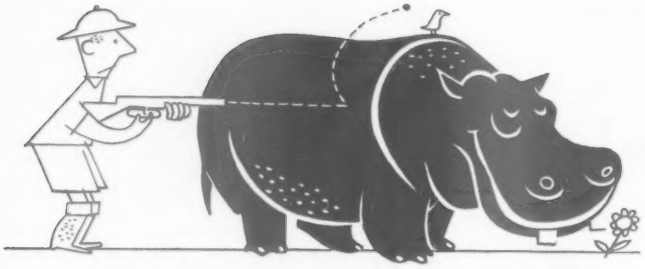
For information on Titanium Developments contact Mallory-Sharon Titanium Corp., Niles, Ohio.



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—and weld spatter can't penetrate P.O.M. When you apply P.O.M. No. 2 to weld seam and adjacent metal you get better, cleaner welds and all spatter wipes off with a dry rag! Protect-O-Metal does not cause smoke or fumes, goes on in a hurry, saves as much as 85% of weld cleaning time and labor. Use P.O.M. No. 8 for rust prevention as well as spatter protection. Order trial gallons of both No. 2 and No. 8. Satisfaction guaranteed or we'll cancel the invoice.

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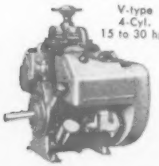
G. W. SMITH & SONS, INC. 5408 KEMP ROAD, DAYTON, O.

Power... To Fit the Job and the Machine

Single Cyl. 3 to 9 hp.

2-Cyl. 7 to 13 hp.


V-type 4-Cyl. 15 to 30 hp.

WISCONSIN
Heavy-Duty Air-Cooled
ENGINES

Today, leading manufacturers of portable welders, construction and oil field equipment, railway maintenance equipment for both on-track and off-track operations, and many types of industrial machines employed in outdoor field service now specify Wisconsin Air-Cooled Engines as *standard* or optional power components . . . integrally mounted on their machines.

This broad acceptance may be credited to the fact that Wisconsin Air-Cooled Engines, because of their extreme compactness, light weight, economical operation and heavy-duty dependability . . . ideally fit both the *machines* and their *service requirements*.

Wisconsin Air-Cooled Engines are supplied in a complete power range, from 3 to 30 hp., in 4-cycle single cylinder, two-cylinder and V-type 4-cylinder models. We will be happy to put you in touch with the nearest Wisconsin Engine distributor and supply you with descriptive and engineering data. Your inquiry is invited.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

30 YEARS AGO

(From THE WELDING ENGINEER of Feb., 1922)

CASUALTIES in the collapse of the Knickerbocker Theater in Washington, D. C., last month were lower than expected because of fast rescue work by oxyacetylene torch crews. Torches were used every foot of the way through reinforced concrete roof and balcony construction. District of Columbia officials have directed all battalion fire chiefs to make lists for future use of Washington locations where oxyacetylene rescue equipment can be quickly secured.

—30 YEARS AGO—

BEGINNING in January, the American Welding Society will publish its own proceedings in monthly bulletin form. For some time part of the proceedings of the Society were published in THE WELDING ENGINEER, but it was thought best by most members to have a separate journal. This worthy undertaking deserves the wholehearted support of the welding industry.

—30 YEARS AGO—

NEW welding gas announced recently is called "Thermalene," a combination of acetylene with an oil gas. A special gas generator may be purchased to produce the compound for shop use.

— 30 YEARS AGO —

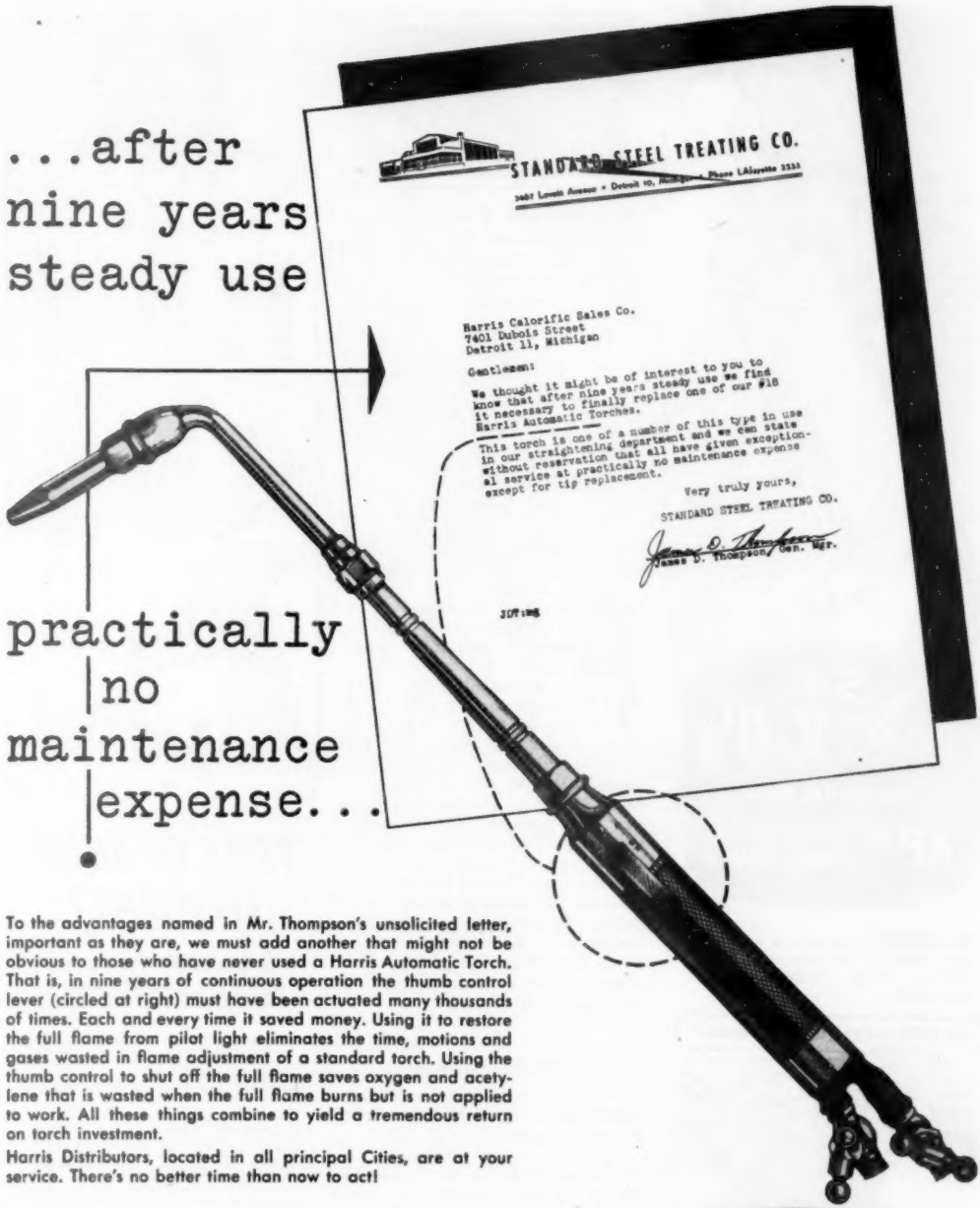
A LOOK ahead into the future five years, to 1927, by G. O. Carter, consulting engineer for Linde Air Products Co. in a WELDING ENGINEER article this month, shows a lot of improvements in the average welding shop. The office work will be done by a clerk who will answer phone calls, post accounts, send out statements, write business letters, etc. The owner will not only oversee all welding but will also concern himself with home-town advertising, technical magazine literature and advertising and direct-mail promotion material. City gas will be used instead of charcoal for most preheating jobs.

—30 YEARS AGO—

WELDORS and boilermakers are probably the worst offenders when it comes to abusing their eyesight. Yet, both types of workers still neglect buying prescription lenses to correct and aid their vision. It isn't enough to wear goggles while welding; real efficiency comes through good vision at all times.

...after nine years steady use

practically no maintenance expense...


STANDARD STEEL TREATING CO.
Harris Calorific Sales Co.
7401 Dubois Street
Detroit 11, Michigan
Gentlemen:
We thought it might be of interest to you to know that after nine years steady use we find it necessary to finally replace one of our #18 Harris Automatic Torches.
This torch is one of a number of this type in use in our straightening department and we can state without reservation that all have given exceptional service at practically no maintenance expense except for tip replacement.
Very truly yours,
STANDARD STEEL TREATING CO.
James D. Thompson, Gen. Mgr.

To the advantages named in Mr. Thompson's unsolicited letter, important as they are, we must add another that might not be obvious to those who have never used a Harris Automatic Torch. That is, in nine years of continuous operation the thumb control lever (circled at right) must have been actuated many thousands of times. Each and every time it saved money. Using it to restore the full flame from pilot light eliminates the time, motions and gases wasted in flame adjustment of a standard torch. Using the thumb control to shut off the full flame saves oxygen and acetylene that is wasted when the full flame burns but is not applied to work. All these things combine to yield a tremendous return on torch investment.

Harris Distributors, located in all principal Cities, are at your service. There's no better time than now to act!

THE HARRIS CALORIFIC COMPANY

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ALL PURPOSE. Takes a wide variety of tips. Excellent for brazing, welding, heating, cutting. Rugged, efficient, dependable.

ASK YOUR LOCAL K-G DISTRIBUTOR!*

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Also M3B Cutting Torches, Pressure Regulators, Complete Outfits, Cutting Machines, Accessories

Catalog on Request

The K-G Equipment Company (Inc.)

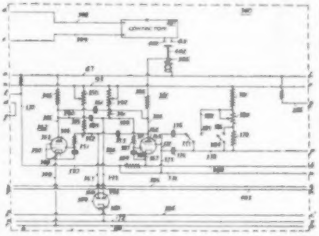
Unit of Air Products, Inc.

Dept. A, 50 Broadway, New York 4, New York

From the Patent Office

Sequence and Welding Timer

2,577,411. DONALD P. FAULK, Lexington, Mass. Assigned to Raytheon Mfg. Co., Newton, Mass. Filed Jan. 31, 1950. Granted Dec. 4, 1951.



A newly patented timing system is used in supplying current through a load from a voltage source. It comprises means for controlling current from the source, a pair of cascade connected controlled-ignition gas-filled discharge devices and means responsive to current flow in the leading one of the discharge devices. The latter means causes the controlling means to conduct current through the load. Means responsive to current flow in the other of the discharge devices causes the controlling means to stop current flow in the load. There are time control means effective only while the one discharge device is conductive for causing the other discharge device to conduct. There are means for extinguishing the one discharge device and thereby extinguishing the other.

* * *

Welding Titanium

2,576,793. JAMES FERNANDO JORDAN, Huntington Park, Calif. Filed Sept. 20, 1950. Granted Nov. 27, 1951.

A newly patented welding process comprises contacting the pre-heated surface of the titanium (or other metal) that is to be welded with gas selected from the group consisting of carbon tetrachloride, hydrogen chloride and mixtures thereof. This is continued until a reaction between the gas and oxygen-bearing compounds on the surface has volatilized a substantial part of the compounds. Welding is carried on under a blanket of this gas.

THE
ARC-FIT
PROCESS
Patented

Tube notched with special ARC-FIT
Angular notch on tubular member.
Square tube notched to fit square pipe.
Angle joint on two pipes.
"T" notch on end of Tubular member.
Pipe Notched with deep slot.
"T" joint on tube or pipe.
Angle iron notched to fit pipe.

TOPS IN SHOP EFFICIENCY

5 seconds to notch Tubing and Pipe Ends

The answer to many problems confronting large and small shop owners. No shop can afford to be without the ARC-FIT—no matter how large or how small. Manual or power operated—fits the ARC-FIT hand press or any standard power press.

ARC-FIT is a patented precision-built shearing tool which prepares the ends of tubing or pipe to produce welded or brazed tubular "T" or angle joints. ARC-FIT will not deform the tube or pipe and no further finishing is required—no sawing, cutting, or removing sections with milling cutters. Our literature gives many fine points on operation, construction, and application—send for it today —also write for quotations.

VOGEL TOOL & DIE CORPORATION

1825 N. 32ND STREET
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MELROSE PARK, ILL.

WALLEX

New hard-facing rod resists heavy abrasion

WALLEX is a new hard-facing alloy made to resist the abrasion on earth moving and rough material handling and crushing equipment. WALLEX has good impact and corrosion resisting properties as well. WALLEX comes as oxy-acetylene rods and also coated for electric arc welding. Welders find either type works fast—they are the easiest rods to use of their kind. Special castings can be made to specification.

If you are doing maintenance work on bucket lips, conveyor parts, cement chutes, grinder rings, crusher teeth—any abrasion worn parts, write for the WALLEX folder and prices.

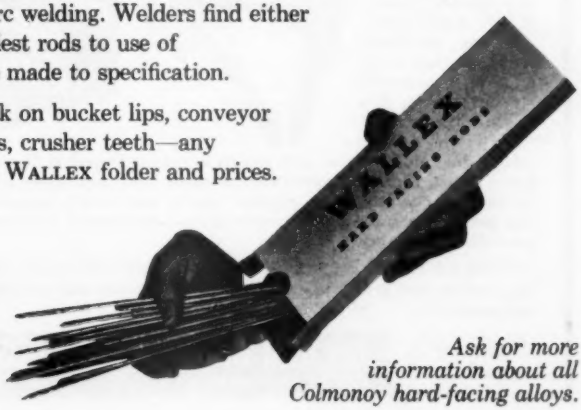
ORDER FROM YOUR LOCAL JOBBER

WALL COLMONOY

CORPORATION

HARD FACING ALLOYS

19345 JOHN R STREET DETROIT 3, MICHIGAN



Ask for more information about all Colmonoy hard-facing alloys.

Let us try to help you . . . We can frequently bring a different viewpoint to your steel problem and find a way to solve it. Possibly we can suggest an alternate material or a production change that will make your steel go farther. Give us a chance—we may have your answer.

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UNITED STATES STEEL COMPANY

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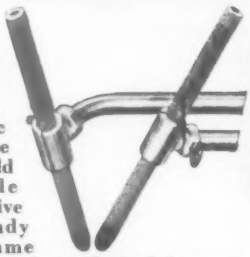
UNITED STATES STEEL

★ ★ ★ **BECKER**

KEEN-ARC CARBONS



FOR CONSISTENTLY GOOD RESULTS

Designed to carry the high currents necessary for intense heat, BBB Keen-Arc Carbons produce a fine-grained weld of high tensile strength. They give a smooth, steady "flowing" flame which does not wander and which is concentrated at the desired focal point. Flame temperature is easily and accurately adjusted by merely changing the ampere input, and heavy copper coating permits gripping at extreme ends—eliminates frequent and periodic resetting.

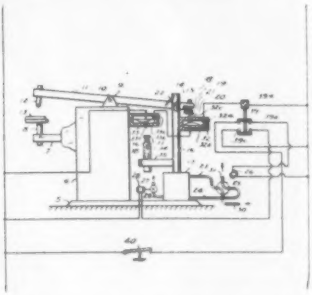
A COMPLETE LINE OF CARBON WELDING SUPPLIES including carbon and graphite electrodes, carbon rods and plates, welding paste, etc.

Write for catalog.

BECKER BROTHERS CARBON CO.
3450 South 52nd Ave. Cicero 50, Illinois

Safety Control on Rocker Arm Welder

2,573,124. JEROME B. WELCH, Wauwatosa, Wis. Assigned to Cutler-Hammer, Inc., Milwaukee. Filed May 3, 1950. Granted Oct. 30, 1951.



A newly patented safety device for rocker-arm spot welders includes a carrier pivotally movable in reverse directions to move one electrode toward or away from the other. A movable member has a "lost-motion" driving connection with the carrier. Movement of this member one way causes the carrier to separate the electrodes. A powered mechanism affords movement of the member to a normal extreme position in one direction or to an extreme position in the other direction. The carrier inherently tends to move its electrode toward the other. It insures take-up of lost motion between it and the moving member as the latter moves between extreme positions (until the carrier electrode contacts the work between the electrodes or is arrested before it contacts the work.) The control for the powered mechanism includes a device responsive to relative movement between the carrier and the member resulting from the arrest of the carrier electrode before it contacts the work. This effects powered movement of the member in one direction.

* * *

Soldering Flux

2,575,413. WILLIAM BENJAMIN FRANKLIN, San Fernando, Calif. Assigned to Joseph J. White, Los Angeles. Filed Oct. 17, 1949. Granted Nov. 27, 1951.

This patent refers to a substantially water-free, flexible, non-corrosive, non-hygroscopic flux for precoating sheet or ribbon solder. It consists of the product formed by melting together a mixture of 1 part rosin, about 1 part of a higher fatty acid and about 0.4 part of a wax having a melting point of about 160 F to 200 F.

★ **ARCALOY** for stainless steel

★ **ARMOR-ARC** for armor welding

★ **BRONZE-ARC** for bronze and cast iron

★ **WELD-ARC** for low hydrogen electrodes

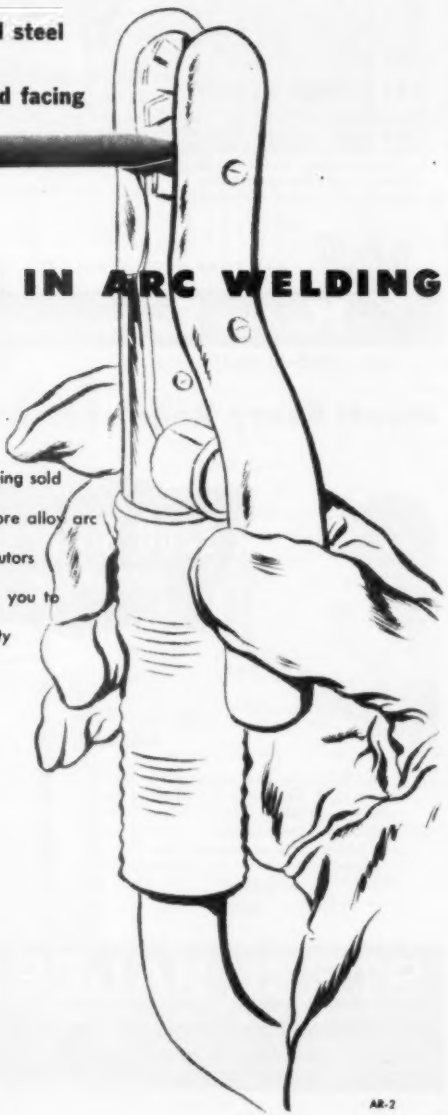
★ **NICKEL-ARC** for cast iron

★ **TOOL-ARC** for tool steel

★ **WEAR-ARC** for hard facing

★

NAMES TO REMEMBER IN ARC WELDING



100% of all *Alloy Rods* production is still being sold through our fine Distributor organization. We are shipping more alloy arc welding electrodes than ever before . . . and while our Distributors may temporarily be out of stock on certain types, we urge you to keep in touch with them on your requirements. After all, *quality* is always worth waiting for.

ALLOY RODS COMPANY

No Finer Electrodes Made . . . Anywhere

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★ *See your nearest Alloy Rods Distributor*

AR-2

Meco SAF-T-CHEK REGULATOR

LASTS . . . 4 Times longer

MULTI-SEAT QUADRUPLES LIFE

Four times the life of ordinary regulators is guaranteed by exclusive four-seat construction. Each seat may be used successively – adjusted simply. No special tools or mechanical skill is required to maintain *any* part of the MECO regulator.

SAF-T-CHEK VALVES

This exclusive MECO construction provides insurance against seat or diaphragm failure. Built-in, self-actuating SAF-T-CHEK valves prevent damage to equipment from careless handling.

BOLTED DIAPHRAGM NEVER PUCKERS

Absolutely uniform pressure and flexibility is secured by *bolting* special alloy diaphragm – instead of conventional screw fastening which puckers diaphragm fibres. Diaphragm should last the life of the regulator.

Close yoke between diaphragm and multi-seat block insures transmission and correction of tiniest pressure variations providing constant and uniform pressure.

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Meets Every Requirement . . .

1200 Silver Brazing Flux

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All-Purpose Stable Quick-Acting

• 1200 Flux, designed for silver brazing, meets U. S. Government and other standard specifications. It dissolves oxides, including chrome, rapidly . . . remains stable at all silver brazing temperatures. And you can brush it on or use any other method of application. Remember . . . 1200 Flux, the next time you place your order!

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Use 1200 Flux for silver brazing Brass, Stainless Steel, Bronze, Nickel-Silver, Steel, Monel, Inconel, Nickel and Cast Iron. Furnished in ½ lb., 1 lb., 5 lb. and 30 lb. containers.

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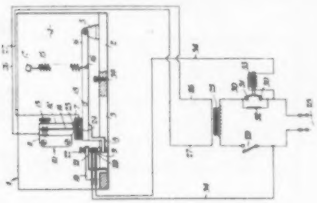
PLANTS: DETROIT, ST. LOUIS, MILWAUKEE, MINNEAPOLIS

OFFICES: INDIANAPOLIS, GRAND RAPIDS, KANSAS CITY

Welding of Tips to Bases

2,571,313, NORMAN ALBERT TUCKER, London, England. Assigned to Johnson, Mathey & Co. Ltd., London. Filed Feb. 27, 1950. Granted Oct. 16, 1951.

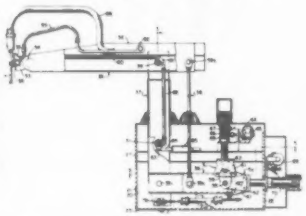


Patent refers to a method of welding a metallic tip to a metallic base in which both elements are held against each other. An electric welding current is passed through both elements to cause melting of at least one of them. A resistance is automatically inserted into the welding circuit as a result of the movement of one of the elements a predetermined distance towards the other. This resistance is sufficient to reduce the welding current to a strength adequate only to delay freezing or solidification of the molten metal.

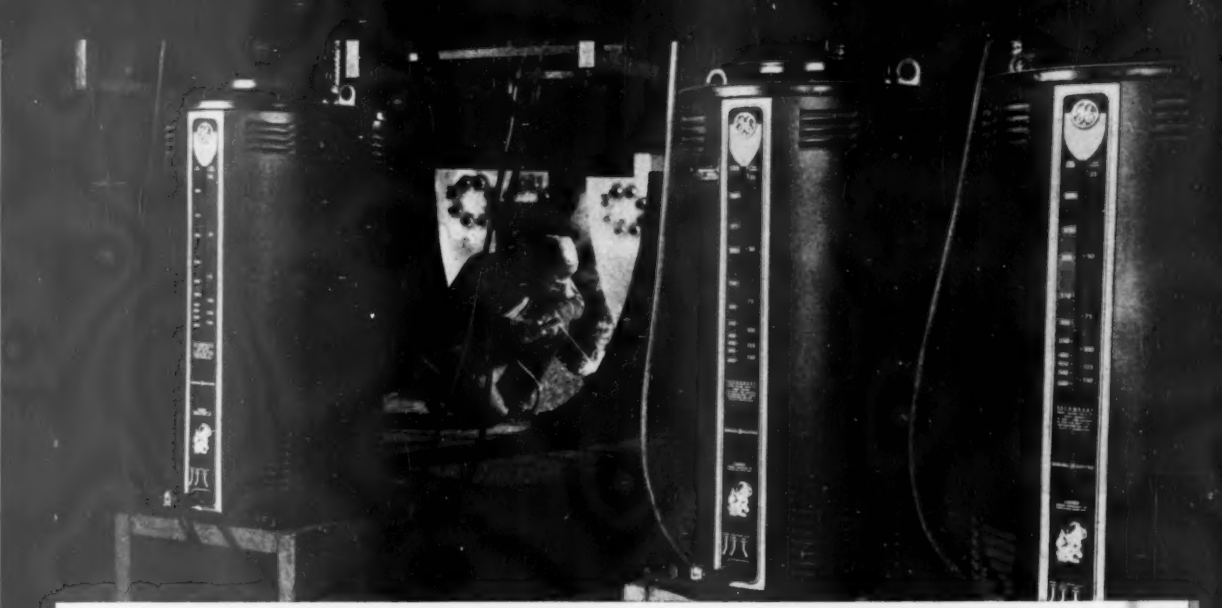
• • •

Flame-Cutting Machine

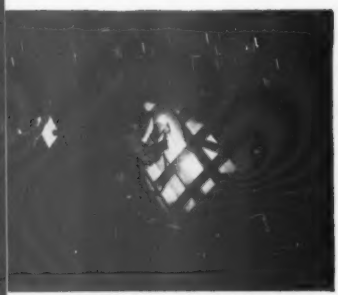
2,574,101. WILLIAM J. GREENE, Plainfield, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed Oct. 30, 1948. Granted Nov. 6, 1951.



A newly patented flame-cutting machine includes a frame and a pair of upper and lower arms pivotally connected to a pair of uprights to form a pantograph structure. This operates in a vertical plane, the upper arm being a torch-carrying arm and the lower one a control arm. One of the upright arms is a main supporting arm for the pantograph. A pivotal connection between the main supporting arm and the frame affords a fixed horizontal axis about which the arm may pivot. A gas cutting torch is mounted on the torch carrying arm. There are means operatively connected to a predetermined part of the control army applying vertical movement to it. Other means are operatively connected to the same region of the control arm, and apply horizontal movement.



BEST FOR 3 OUT OF 4 WELDING JOBS!



WELDING SPEEDS INCREASED 20% after this company switched to AC. Deposition rates may be doubled because AC permits the use of higher currents and larger electrodes.

AC ELIMINATES TROUBLESOME ARC BLOW, permitting these weldors to deposit ¾ inch fillet up to 20% faster. AC is the ideal choice for deep fillet welding because the operator can easily control the arc.

AC CUT COSTS 10% and increased welding speeds 15% for this iron works. With AC, you save four ways —on labor, electrodes, power and original cost.

IMPROVED WELD QUALITY enabled this plant to meet rigid specifications on diesel engine crank cases and marine gear cases. The absence of arc blow makes it easy to deposit weld metal smoothly and uniformly, even in grooves and corners.

G-E AC Welders Increase Speed, Improve Weld Quality, Cut Costs, Eliminate Arc Blow

See Your G-E Arc Welding Distributor for complete information on G-E AC welders. They are available in 200- to 500-amp ratings for indoor or outdoor use. Most models are available on short delivery. Your distributor also carries a complete line of DC, engine-driven, Inert-Arc and Atomic-Hydrogen welders, plus electrodes and accessories. You can find your nearest distributor's name by looking for General Electric under "Welding Equipment" in the yellow pages of your telephone directory.

Section B711-20, General Electric Company, Schenectady 5, N. Y.

Please send me immediately publications on the following G- AC welders.

× for immediate project
√ for reference

- ☐ **200-amp, GEC-553**
- ☐ **300-amp, GEC-652**
- ☐ **400-amp, GEC-730**
- ☐ **500-amp, GEC-812**
- ☐ **300-amp Indoor or Outdoor Model, GEC-779**

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City ..... **State** .....

GENERAL ELECTRIC

Group of RUEMELIN Fume Collectors Keeps Shop Clear of Welding Fumes

This well ventilated welding department is typical of hundreds of similar installations. Welding operators appreciate smoke and gas-free atmosphere. Thousands in service. Many repeat orders. Collecting fumes at the source with local exhaust hoods has proven most practical in operation. It is particularly helpful in winter months when doors and windows are closed. Write for Bulletin 37-D describing all types of Ruemelin Fume Collectors.

RUEMELIN MFG. CO.

MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT
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It's No Secret Practically everybody in the field knows . . .

MANGANAL

U.S. Patents 1,876,738—1,947,167—2,021,945

11%-13½% MANGANESE-NICKEL STEEL
APPLICATOR BARS AND WELDING ELECTRODES
are used to . . .

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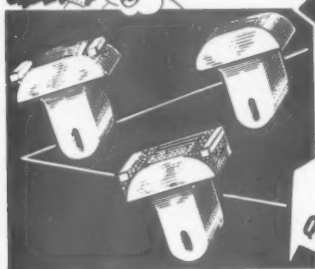

- MANGANAL usually outlasts new hammers.
- MANGANAL practically eliminates build-up time.
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REDUCE COSTS STILL MORE
. . . by using a single pass of SEACO hard-surfacing electrodes. It allows the steel to workharden before wear hits it.

FREE Helpful literature on how to reduce costs on repairs of Quarry, Mining and Contractors equipment.

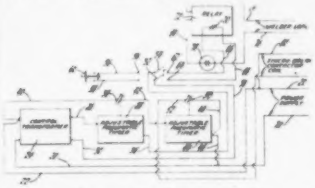
NAME OF NEAREST DISTRIBUTOR ON REQUEST

Send for catalog and price list.

STULZ-SICKLES CO. SOLE PRODUCERS
92 N. J. Railroad Ave.
Newark 5, New Jersey

Arc Welder Interrupter

2,573,020. ARTHUR F. HESSLER, NAPOLEON P. BORETTI, and KARL SARAFIAN, Detroit. Assigned to General Motors Corp., Detroit. Filed March 1, 1950. Granted Oct. 30, 1951.

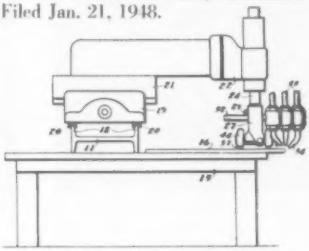


A newly patented control for arc welders consists of a number of time delay relays connected in sequence to the power source and two switches operated by the relays. The final time-delay operates one of the switches which is also connected to the other switch. A control relay is connected across one time-delay relay. A manually-operated switch is connected in circuit with the control relay to determine the character of operation of the control system so that the timed sequence may be initiated manually.

* * *

Mounting for Cutting Torch

2,574,100. HAROLD R. GETTYS, North Bend, and RUSSELL P. KISSICK, Cincinnati, O. Assigned to Stacey Brothers Gas Construction Co., Cincinnati. Filed Jan. 21, 1948.



A newly patented mounting for flame-trimming the edges of metal plates consists of a carriage for supporting a number of cutting torch tips in angular relationship to the edge of the plate and to each other. The carriage has spaced co-axial wheels. A yoke with arms straddles the carriage. The carriage is mounted between the arms of the yoke for free swivelling movement about a horizontal axis transverse to the axis of the carriage wheels. Means are provided for mounting the yoke for vertical floating movement above the plate. This allows accommodation for variations in the plate surface next to the edge and engaged by the wheels. The carriage floats and swivels in accordance with the tracking contact of the wheels. The position of the cutting tips stays the same relative to the edge of the plate.

Take advantage of exclusive P&H AC Dial-lectric principle

give your production a lift

— with safe, open-circuit voltage . . . easy, quick-start arc . . . time-saving, built-in remote control . . . compact AC design

Armor plate welding calls for low-hydrogen or stainless steel electrodes. P&H, pioneer in the low-hydrogen field, also offers the AC welder that gives you the best weldability with these rods — for greater production.

Your men like the P&H AC Dial-lectric — like its safety under the most adverse conditions; like the easy, quick-start arc, the elimination of arc-blow. And they get more done! Get sounder, better looking welds in less time, thanks to built-in remote control which lets them select the right heat at the work, turns *walking time* into *welding time.*

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One of the numerous products in which Fitzgibbons employs KSM Solid-Fluxed Studs to advantage is the domestic hot water heater pictured above.

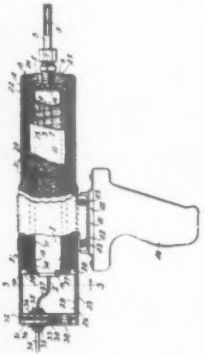
Have you looked into Stud Welding for **your** important fastening jobs? It's a thoroughly modern method that saves important man hours in installation. And when the installation is completed, the resulting weld makes a fastener that is strong and permanent in a manner that no other type of fastener can duplicate. For more information write for Bulletin 1002. KSM PRODUCTS, INC., MERCHANTVILLE, N. J.

KSM PRODUCTS INC ®

ARC WELDING STUDS

Flameless Hot Gas Torch

2,577,269. HENRY M. RICHARDSON, Springfield, and FRED E. WILEY, Leominster, Mass. Assigned to De Bell & Richardson, Hazardville, Conn. Filed Nov. 16, 1949. Granted Dec. 4, 1951.

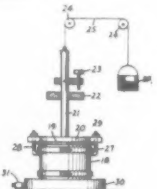


Patent covers a flameless torch built on a heat exchanger principle. The latter consists of an annular passage packed throughout its length with a reticulate mass of metallic material, a helical passage and an electrical heater arranged in series. The reticulate (netted or net-like) mass is in heat exchanging relation with the foremost part at least of the adjacent helical passage. There are means to introduce gas to the annular passage under pressure for turbulent flow through the passages and around the heater counter current to the heat gradient.

* * *

Tube Welding Method

2,577,123. AARON L. HITCHENS, New Haven, Conn., and FREDERICK G. STROKE, Temple, Pa. Assigned to Olin Industries, Inc., New Haven, Conn. Filed Oct. 16, 1946. Granted Dec. 4, 1951.

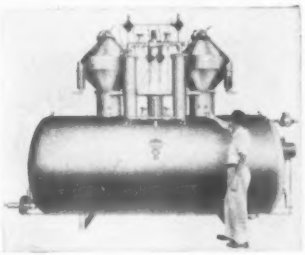


Patent refers to a method of bonding a bundle of aluminum tubes having prehexed expanded ends. The method comprises preheating the tubes to an elevated temperature less than welding temperature, and applying heat to a welding member having a plane horizontal welding surface at

BIGGEST ACETYLENE PLANT NEWS IN 25 YEARS!...

Sight Feed

MODEL A-TWIN ACETYLENE GENERATORS



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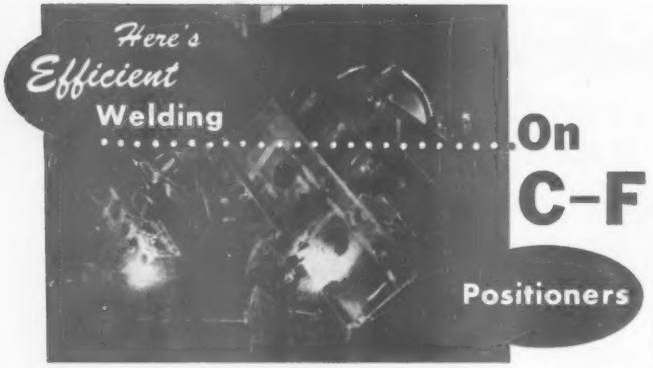

When heavy, unwieldy weldments like these diesel crank cases can be quickly swung into any position so that every weld is made **downhand**—that's efficient welding!

Weldors spend more time welding—do better welding at lower cost when they work with C-F Positioners because these hand and/or power operated machines reduce positioning time to a minimum. Investigate the cost-saving advantages of C-F Positioners. They pay their way in any company.

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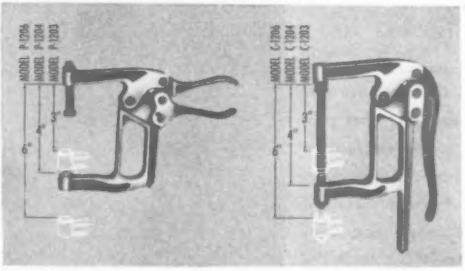
CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

Six
NEW
Clamps



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REQUIRE LESS EFFORT TO CLAMP

Here is another forward step in KNU-Vise clamps for efficient, fast and secure clamping.

These six new clamps made of heat-treated steel forgings are stiffer, yet lighter, and require less hand effort to clamp. At the same time, a greater clamping force is obtained. In addition, the new hand-hold design of the C-Clamp (at right) provides a guard to protect the user's fingers while clamping. A second spindle, instead of the anvil, can be furnished for special applications.

Sales offices in principal cities. Teletype DE 49.

KNU-VISE PRODUCTS

LAPEER MANUFACTURING CO.
3042 DAVISON ROAD • LAPEER, MICHIGAN

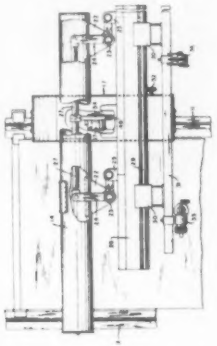
Western Division, 422 Magnolia St. Glendale, Calif.

a point removed from the welding surface to raise it to welding temperature. The welding surface is covered with flux which melts. By bringing together the heated, flux-covered welding surface and the preheated tube bundle, the edges of the tube ends are selectively melted without melting the tube bodies. The feeding movement of the tubes toward the welding surface is stopped after a predetermined amount of the tube ends has been melted. Immediate separation of the tube bundle and welding member causes the molten metal to cast the ends of the tubes together.

* * *

Universal Torch Machine

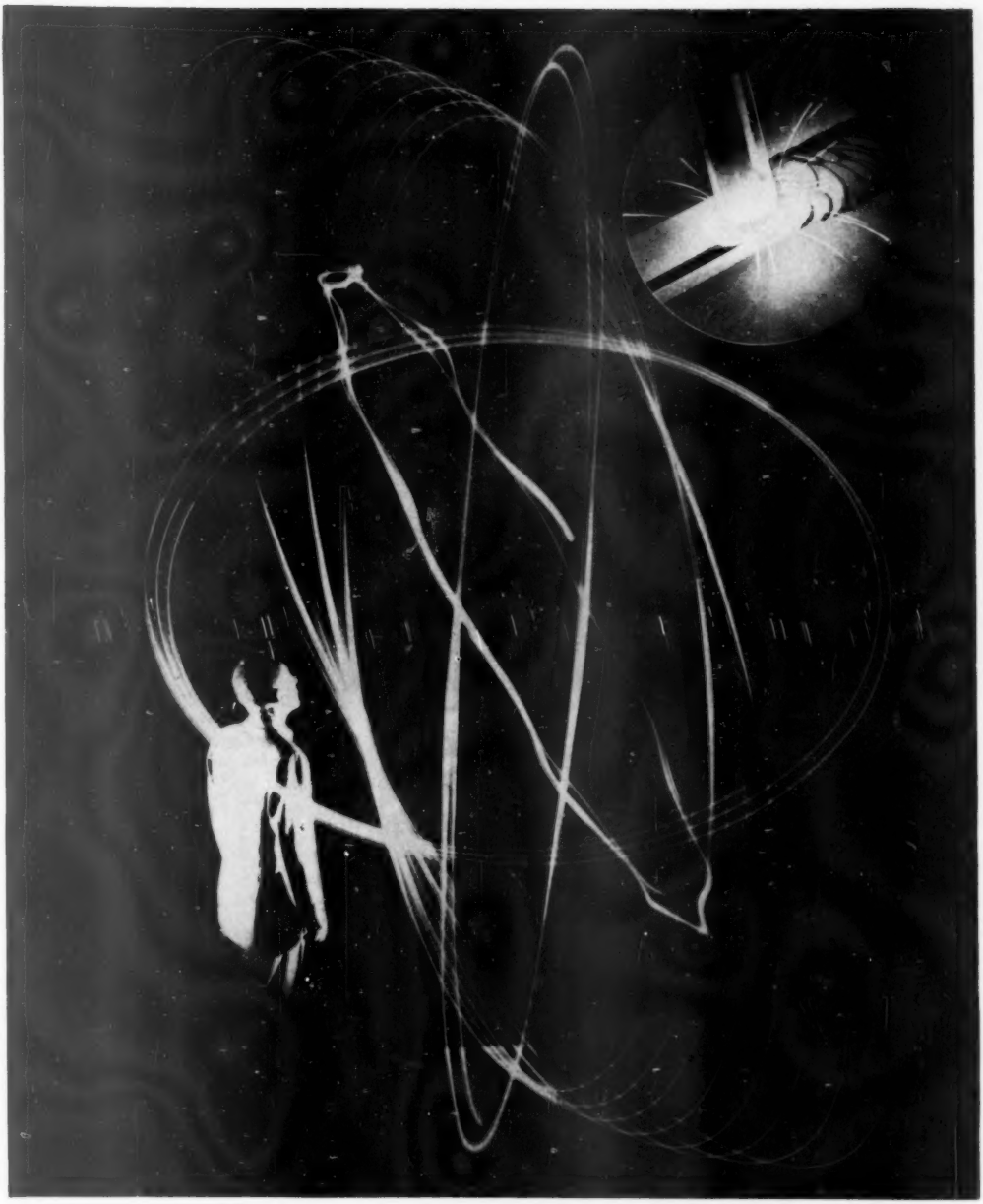
2,571,248. ARTHUR R. HUTT, Chatham, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed March 30, 1948. Granted Oct. 16, 1951.



A newly patented universal torch machine of the double rectilinear motion type comprises a movable base carriage guided to move along a path rectilinearly. It has reversible power driving means. A pair of arms pivotally connect a guide bar at spaced points to parts of the base carriage and restrain it against substantial lengthwise movement. It can only move a small way relative to the base carriage laterally of itself and longitudinally of the line of travel of the carriage. A tracer and torch are mounted for unitary movement along the guide bar and guided thereon to move rectilinearly at right angles to the line of travel of the carriage. Means are connected to the arms for actuation by them and operated as a result of movement of the guide bar by the tracer.

* * *

The U. S. produced 105,253,000 tons of steel in 1951.



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*TAM and RUFLUX are registered trademarks.

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Our part time welder-patriot Paul made a pretty necessary trip that dark night, many long years ago.

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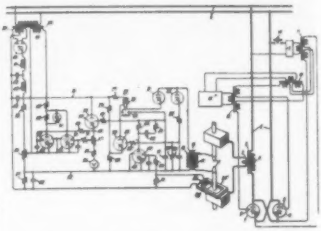
Testing Spot Welds

2,577,163. EUGENE R. SPITTLER and IVAR W. JOHNSON, Schenectady, N. Y. Assigned to General Electric Corp. Filed May 4, 1944. Granted Dec. 4, 1951.



This patent tells about a method of resistance welding metallic work parts. Welding current is supplied to the work parts through pressure-exerting electrodes in order to form a weld between them. Special means measure the voltage across the weld during its formation and interrupt the flow of welding current through the electrodes when the voltage across the weld attains a substantially constant value.

* * *

Quick-Release Attachment

2,576,286. MURRAY EISENBERG, New York City. Filed April 5, 1945. Granted Nov. 27, 1951.

Patent refers to an attachment for a pair of vise-grip pliers having a handle and articulated lever movable in one direction to lock the jaws. The articulated lever is provided with a medial pivot including a pivot pin. A cam plate is provided with a bore to receive the pivot pin, thus positioning the cam plate on the pivot for camming engagement with an element other than the articulated lever. This urges the articulated lever in the other direction to unlock the jaws.

Weldimatic means **Fully Automatic**

Top Brass!

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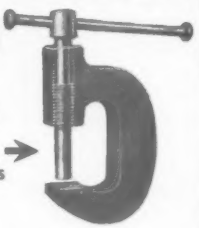
WELDING CLAMPS



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NEW YORK 1, N. Y.

NEW PRODUCTS

(Continued from page 47)

Lightweight Sander

FAST grinding, polishing, wire brushing and sanding are claimed for the new Millers Falls No. 870 7-in. industrial sander. It can be used with standard wheels, discs and brushes as well as the new laminated phenolic grinding wheels and discs.

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DILLON "Temperometer" will measure the exact temperature of molten babbit metal, solder, lead and other molten metals that do not exceed its upper limit of 1,000 F. The actuating element is a bimetallic coil enclosed in a tube. When the tube is lowered into molten material, heat is transmitted to the sensitive coil, which revolves in proportion to the degree of heat. A pointer attached to the end of the shaft indicates the temperature on a calibrated dial. Temperature ranges on the dial are marked for such jobs as impregnation wax, paraffin telephone cable, wiping solder telephone cable, wiping solder power cable, the latter being in the upper range of 875 to 1,000 F.

This instrument was formerly made of 3/4-in. steel tubing with a die-cast head. The improved new model is fabricated entirely of stainless steel to resist corrosion. Also, the end of the tube is now closed so that colutions cannot enter and foul the coil.

W. C. DILLON & CO., INC., 1421 South Circle Ave., Forest Park (Chicago), Ill.

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Special solder for aluminum—drawn or cast—ignite castings, and die-cast metals. Can be used with soldering iron or under direct flame—self fluxing.

★ HARD SOLDER
Withstands high temperatures, heavy wear, expansion, and contraction—can be flowed in at 620° F. Use with any kind of heat.

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METAL BOND MFG. CO.
3201 KOSSUTH AVE.
ST. LOUIS 7, MISSOURI

Ni-Cr-Fe Welding Electrode

2,576,123. THEODORE E. KIHLGREN, Berkeley Heights, N. J. and JOSEPH S. BRYNER, State College, Pa. Assigned to The International Nickel Company, Inc., New York City. Filed May 24, 1950. Granted Nov. 27, 1951.

Patent refers to a welding electrode that gives deposits substantially free of gas porosity in a-c and d-c welding circuits. It comprises a nickel-base alloy core wire and a flux coating that contains up to 30 parts by weight of calcium carbonate, from 9 to 25 parts of barium fluoride, from 10 to 50 parts of cryolite, up to 32 parts of ferro-50 columbium, up to 12 parts of ferro-40 titanium, from 2 to 5 parts of bentonite and from 1 to 5 parts of dextrine.

* * *

"Tel-O-Set" controller is a product of Minneapolis-Honeywell Regulator Co., Wayne & Windrim Avenues, Philadelphia 44, is described as the latest component in a series of new devices designed to improve process control. It provides sensitive control of flow, temperature, pressure, liquid level and other industrial process variables.

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I DON'T KNOW HOW TO PUSH THE BOYS ANY HARDER!
WAIT'LL THEY START USING THAT CHAMPION BLACK DEVIL— THEY'LL GET THAT INCREASED PRODUCTION EASILY WITH THEIR SAME MANPOWER
THOSE WELDERS ARE SURE A HAPPY CREW. WITH THAT FAST-BURNING HIGH DEPOSIT RATE CHAMPION BLACK DEVIL THEY'RE BATTING A THOUSAND ON THAT PRODUCTION SCHEDULE!
NO UNDER CUT ON THE EDGES— PRACTICALLY NO SPATTER TO CLEAN OFF— SLAG CAME OFF EASY BETWEEN PASSES!
THE APPEARANCE OF THE WELDS IS FIRST RATE, SMOOTH, EVEN AND THOSE X-RAYS SHOW PERFECT!
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S33—Silver brazing of ferrous and non-ferrous metals
S34—Silver brazing of high alloy stainless steels
S35—Silver brazing of aluminum bronze
C22—Brazing of copper, brass and bronze
A11—Welding of aluminum and aluminum alloys
A22—Brazing of aluminum and aluminum alloys
M11—Welding of magnesium and magnesium alloys
F11—Welding of cast iron
F22—Brazing of cast iron
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A S L SERIES

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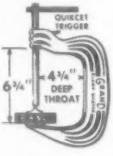

Grand Speed Clamps have extra deep throats—are ruggedly built of NACO No. 6 Steel—spatter proofed.

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What Does Business Look Like for 1952?

BUSINESS as a whole will carry on at a very high level throughout 1952, says a recent report from the department of economics of McGraw-Hill Publishing Co., Inc. The sum total of everything produced (gross national product) will rise 4 or 5 per cent this year.

Output in manufacturing and mining (industrial production) may rise as much as 7 or 8 per cent during the year. Most of the rise will be in defense industries and the recently depressed soft goods lines.

In 1951 the textile and consumer goods industries presented the unusual picture of a severe recession within the framework of a general boom. They had produced more than the consumers would take. Most companies operating in these zones are working their way out of their troubles.

Large segments of business are likely to become increasingly competitive, according to the report. Even now, the only parts of the production industries that are still in full boom are the capital goods industries (if you don't look at the military). Toward the end of the year, when new plants and equipment directly required by the defense mobilization are set, a good many businessmen will be trying hard again for customers.

Prices probably won't rise much on the average, guess the McGraw-Hill experts. Maybe 2 or 3 per cent, which is against the trend usually recorded in years when competition is getting tougher. That thinking (more competition brings lower costs) isn't true anymore—wage rates are pushed up in national "rounds" each year and the effect complicates the old rule.

From now on defense expenditures won't be as high as was formerly predicted and expected, though they'll still rise. This means that some companies relying largely on defense spending are likely to take a fall. On the other side of the fence, though, consumers will be able to buy goods more carefully without fear of extensive shortages.

This means companies selling directly to consumers will have to make more careful plans about supplies—it isn't likely more buyers' rushes like the last two will come along to tide over mistakes.

Dollar-wise, the annual rate of defense spending will increase about one billion dollars per month during 1952 and reach sixty billion, or more by the end of the year. Even with the spending rise, it's possible that de-

Stop LOSING MONEY!

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RIO, WISCONSIN

IN 4 SIZES

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This is an extremely comfortable eye shield which achieved instant popularity when first offered in the smaller sizes.

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Shop owners and safety engineers from the Atlantic to the Pacific, from Canada to the Gulf, have urged us to furnish this eye shield in the larger sizes for use with prescription glasses.

Order From Your Dealer

If you are a shop owner or safety engineer and if you are not already furnishing this eye shield to your workers, we urge you to order a few pair from your dealer for test purposes.

Remember this is an exclusive Sellstrom "Jumbo" Eye Shield. Be sure to specify "Sellstrom" when ordering from your dealer. If he cannot supply you, write us direct.

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626 North Aberdeen St., Chicago 22, Ill.

fense production schedules will be cut back in 1952.

Except for airplanes, that is. The exceptional performance of the MIG's in Korea will keep our aircraft industry on its toes turning out new models in considerable quantities. Tanks are being made at a slow pace now, too, so there won't be cut backs on them till at least later in the year.

Two principle effects are seen as a result of the rising dollar expenditure for defense: the metalworking industries will have all they can handle in material shortage problems and production schedules, and the government will have a big deficit for the year.

Private power companies will spend 25 per cent more on expansion plans during 1952, according to *Electrical World*, a McGraw-Hill publication. This tremendous figure added to those announced by railroad, steel, chemical and oil companies will make capital expenditures in 1952 close to those for 1951.

Total consumer expenditures have been increasing steadily but slowly, about in line with the gain in personal income (after taxes). High-level employment in defense and capital goods industries, plus continuing wage increases, suggest that personal income will rise steadily as 1952 goes on. One thing to remember is that by mid-1952, most people who bought durable goods in the December 1950 - January, 1951, buying wave will have paid off their installment debts.

Some restraint in consumer buying would probably be a good thing. Right now they're buying at a rate almost as high as during the early 1951 spending wave, although more of current expenditures are for food and less for clothing, home furnishings and autos. With some shortages expected in 1952, a new rush to spend would result chiefly in higher prices, with little or no increase in real per capita consumption.

As far as politics goes, the November elections will probably see a fairly stable economic situation. It probably isn't in the power of the administration to upset very much the situation toward a rosier outlook and it won't want to do much in the other direction, for obvious reasons. Another thing, says the report, there never has been a serious business letdown in the second half of a presidential campaign. The election will have a bearing on business for the long run, no doubt about it, but this year it should just add an exciting event to a mainly prosperous economy.

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Better Conductivity • Easy Maintenance

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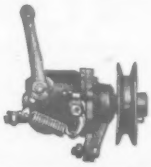

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ELECTRIC AND GAS WELDING

Drawn Wire
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Brazing 716

FOR CAST ALUMINUM

Use Extruded Rods
Types 142, 195, 355 and 356
for Better Welding
3/16" size only

Aluminum Solder
White Metal

Welding Alloys Manufacturing Co.
744 Broad St. Newark 2, N. J.

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Floor space occupied by the two testing units in normal position side by side is 31 in. deep by 74 in. wide.

BALDWIN-LIMA-HAMILTON CORP., 940 Simpson St., Philadelphia 42.

* * *

10 Minute Rust Proofer

ADVANTAGES claimed for a new rust preventive named FD-425, include a 10-minute drying period, temperature resistance from minus 100 F to 250 F and exceptional resistance to salt air and industrial fumes. It may be applied over damp surfaces (interior or exterior), galvanized metal and new or rusted metal surfaces of all kinds, says the company. The one coat leaves an attractive, semi-gloss finish and is available in several colors including aluminum and clear.

UNITED LABORATORIES, INC., 16801 Euclid Ave., Cleveland 12.

NEW PRODUCTS BRIEFS

1-quart air-pressurized fire extinguisher aims and operates like a gun. It discharges a vaporizing liquid that extinguishes both flammable liquid and electrical fires. American-LaFrance-Foamite Corp., Elmira, N. Y.

* * *

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HITCH on to these

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Model 1-B
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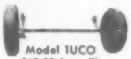

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Display Advertising keeps your name before the public and builds prestige.

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In view of present day difficulties in maintaining your own mailing lists, our efficient personalized service is particularly important in securing the comprehensive market coverage you need and want.

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330 West 42nd St., New York 18, N. Y.

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The advertising rate is $8.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. W.E.

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Old established Midwest manufacturer desires graduate engineer, age 22-30, to aid in planning the design, production and sale of portable engine-driven welders. Please give detailed information on practical welding experience, education, salary desired and other pertinent data.

P2627 WELDING ENGINEER
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WANTED
WELDING ENGINEER—FOREMAN

We have an opening for a man qualified as a Welding Engineer with experience in fabrication of boilers, pressure vessels and plate work. Must locate in small town in northern New Jersey.

P2719 Welding Engineer
330 W. 42 St., New York 18, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

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ESTIMATOR—Jr. Engineer, must have at least 5 yrs. welding and job shop experience, supervision, estimating, expediting, etc.; plate, pipe, misc. iron. Full details in first letter. P-2900, Welding Engineer.

HELP WANTED. The Taylor-Winfield Corporation, 1052 Mahoning Avenue, N.W., Warren, Ohio, a leading electric resistance welder and electronic control manufacturer, has five openings for Design Engineers in their Mechanical Engineering Department. These are permanent positions, provided men selected prove they have the necessary skill and ability. Men with resistance welding design experience are preferred. However, recent mechanical engineering graduates will be given careful consideration. The work is 100% board work, involving the design of electric resistance welder machines and component parts such as jigs and fixtures used in conjunction with this type equipment. Experience or training in electro-mechanical machinery would be a definite asset in meeting the job requirements. Interested applicants should write the Personnel Department stating, age, education, experience, salary expected and other pertinent data.

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SALESMAN WANTED—Good opportunity with fast growing company in Cleveland, Ohio. Selling—Gas-Arc-Spot Nationally advertised Welding Equipment and Supplies. Write stating experience and expectations. SW-2064, Welding Engineer.

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PATENTS

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COATED ALUMINUM ROD FOR GAS WELDING

850# ⅛" 5% silicon for welding 52S and 53S.
Also 300# 5/32" bare and 100# 1/16" bare.
All fresh stock
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2725 Chicago Road
Chicago Heights, Illinois

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Ampco-Trode, 3/16"— 10 Alum. BR...90c-lb.
Arcos, ⅛" Chromang 19/9 MN
Type, 307 Stainless.....60c-lb.
Murex, 5/32" 18/8 MO Stainless.....80c-lb.

Scranton Welding Supply Company
1301 Wyoming Avenue Scranton, Penna.

OXYGEN PLANT—Air Products 600 Cu. Ft. per Hour (20-25 Meters)

Complete—A-1 Condition, Liquid Pump, Westinghouse 60 H.P. Electric Motor, Worthington Air Compressor—Disposing of this Plant because installing larger one—Price Complete $6,500.00.

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700#	1/8"	Walco E-43	35c
400#	3/16"	Walco E-43	35c

GENERAL DISTRIBUTING CO.
Great Falls, Montana P. O. Box 1255

ELECTRODES

1200 lbs. Haynes 93 Hard Surfacing Coated Electrodes 1/4 diameter.
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Welding Engineer

330 W. 42nd St., New York 36, N. Y.

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AIRCO Oxy-graph, Camographs, Radiagraphs.
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SPOT WELDER, National, 40 KVA for Brass and Stainless
BRONZE STAINLESS, AMPCOTRODES.
NO. 12 LENSES, ELECTRODE HOLDERS.
RALL SUPPLY CO. 110 E. 42nd St., NYC 17

OXYGEN AND ACETYLENE CYLINDERS

Reconditioned and Tested
Available for immediate delivery
Write for details
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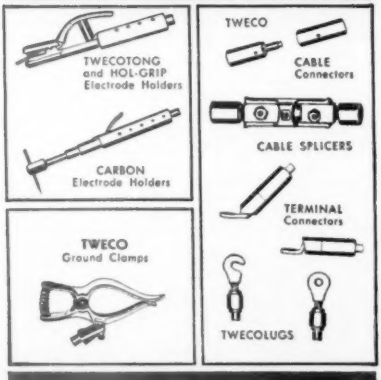
STOP WELDING LOSSES *with* TWECO CABLE Connections

There are warning signals in welding shops that are sometimes overlooked by busy executives. These signals mean lost arc time that almost invariably results in wasted man-hours, lowered production and less profit from the welding process. Heat belongs in the welding arc and no other place; when it appears elsewhere in the welding circuit, it is a signal that says, "Something is wrong." TWECO cable connections will improve your profit picture. Write for our "Causes and Cures" bulletin on this problem.

2 HUSKY MEMBERS of a sturdy welding family

TWECO stands guard over welding profits

A welding circuit is a pipeline for electric current; it can no more operate efficiently with poor connections than your garden hose at home. Poor connections are a menace to production and profits. If you "Weld with Tweco" you operate at maximum efficiency from the ground to the holder.



TWECOTONG is cool running in the toughest going. Avoid blistered operator hands and lost man-hours with TWECOTONG. There is a TWECOTONG for every job. Five models give a range to fit rod sizes and amperage needed. Unnecessary operator fatigue is avoided if you "Job-select" your holder from the TWECOTONG line. Remember too, that TWECOTONG'S tough multi-layer glass cloth "Super-Mel" tip insulation is quickly replaceable. Long lasting "Super-Mel" tip insulation (now standard on all models) is especially valuable where heats are extreme and service is severe. Switch to TWECOTONG for increased welding efficiency.

TWECOTONG PRICES

Model A-38	Model A-14	Model A-732	Model A-316	Model A-532
500 AMPS for 3/8-3/32" rod	300 AMPS for 1/4-1/16" rod	300 AMPS 7/32-1/16" rod	250 AMPS for 3/16-1/16" rod	200 AMPS for 5/32-1/16" rod
$6.50	$5.00	$5.00	$4.75	$4.50

It is important to have a solid ground connection that is quickly removable and easily attached again to the work. INSIST on TWECO Ground Clamps for this purpose. TWECO Ground Clamps have powerful jaw grip for positive contact, easy-on, easy-off grounding. Junior and Senior clamps have a heavy copper braid between the jaws—welded-in so both will carry current. Insulated springs. High copper alloy construction. A size for every work requirement.

TWECO GROUND CLAMP PRICES

Model	Amp. Capacity	Cable Capacity	Price
Midget	125 ampere	No. 6, 4, 2	$1.50
Jr.	300 ampere	4, 2, 1, 1/0	3.00
Sr.	500 ampere	1/0 thru 4/0	4.50

Write for Quantity prices. They save you 10 to 27%

Write for Twecolog 58 giving data and prices on the complete TWECO line of electrode holders, ground clamps and cable connections for electric welding.

Tweco MANUFACTURERS OF ELECTRODE HOLDERS • GROUND CLAMPS • CABLE CONNECTIONS FOR ELECTRIC WELDING

PRODUCTS COMPANY

BOSTON AT MOSLEY • WICHITA 1, KANSAS

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